PRIMARY ARITHMETIC

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PRESENTED BY

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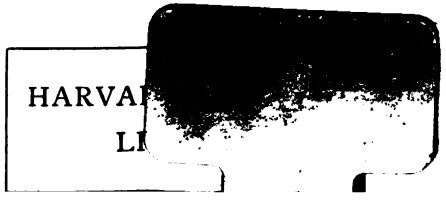
Received May 15, 1903.



ARITHMETIC

GLOBE SERIES IN THREE BOOKS

PRIMARY

(SECOND AND THIRD YEARS)

RATIO AND NUMBER

BY

WILLIAM E. CHANCELLOR, M.A.
SUPERINTENDENT OF SCHOOLS, BLOOMFIELD, N.J.

GLOBE SCHOOL BOOK COMPANY
NEW YORK AND CHICAGO

"If a child learns how to use the text-book, he learns how to make use of the experience of mankind. The text-book enables the child to do individual work for himself, and helps him to become independent of oral teaching."

"The proper use of the printed page is the greatest of all arts taught in the school. How to get out of printed words and sentences the original thought and observation recorded there — how to verify these and critically go over the steps of the author's mind — this is the method of discovery, and leads to the only real progress."

W. T. HARRIS, LL.D.,
United States Commissioner of Education.

From Address before the National Educational Association, 1896.

"The impotence of the pupil to use books by himself must be overcome if he is ever to become a scholar; and it can be done in only one way, — first, by preparing him to use books, and then setting him to use them by himself."

B. A. HINSDALE, LL.D.,
Professor of the Science and Art of Teaching, University of Michigan.

From "The Art of Study."

"The elementary arithmetic stands next to the reader as a means of training children in thought reading, and especially is this true when it contains numerous simple problems for study, and solution."

E. E. WHITE, LL.D.

The Art of Teaching."

M. P. 1

MANHATTAN PRESS
474 WEST BROADWAY
NEW YORK

PREFACE

THIS book is intended for boys and girls who know the numbers from one to ten thoroughly. For such pupils there is here about two and a half years' work.

How should boys and girls study numbers? The interrelations of number-facts and of number-principles are such as to make progress very slow and very difficult through their intricate maze. Is there any Ariadne's thread to follow through the labyrinth of numbers?

Is number ratio or counting? Is it comparison, or magnitude, or multitude? Is it a logic of thought, which can be analyzed after the topical style, — addition, subtraction, multiplication, division, rule of three, and so forth, — of which we may complete one part before beginning the next? Shall we learn every discoverable fact about twenty before taking up twenty-one, or every conceivable fact about $\frac{1}{3}$ of $\frac{6}{7}$ of $\frac{2}{3}$ of $\frac{13}{16}$ before taking up liquid measure?

This book is both "topical" and "spiral" in plan. Its substance is both ratio and counting. Its purpose is to conform numbers in their facts and principles to the usual processes and powers and interests of children's minds. The graded reader has opened the way for the graded arithmetic. Grading all books is part and parcel of the new education, which means to discover and to obey the facts of the child-mind, its methods, nascent periods, and order of growth.

The core of the concentric theory is recognition of the value of finding something that is known even in the mass of the unknown. Let us not hesitate in schoolbooks as we do not hesitate in life to branch out into the new and to return again to the old. Because ratio is the root and numbering is the top, let us not forget reasoning, which is the main trunk of arithmetic. The child's knowledge of arithmetic should grow as evenly in all directions as the most careful and the most open-minded education can secure.

Progress in education is largely a matter of progress in power to

understand books. Oral instruction may be continued too long as the sole medium for imparting knowledge. This book is rather for reading and study than for the setting of many exercises in writing figures. It calls for oral expression far more than for written work; but it is meant to call most for the quiet, studious effort of the child to think through the number-processes for himself in the light of the instruction of the teacher and of these pages. Many minds, of adults as well as of children, cannot at once comprehend principles and facts explained orally. We often need to see the printed words, and slowly and patiently to think out their truth and meaning for ourselves. We remember with more than twofold certainty what we have verified for ourselves after hearing from others.

We cannot advance far in mathematics without giving ourselves to symbols wholly. No one can add 50 and 40 with the picture of 90 real objects in his imagination. By this book we reach the stage where we can properly think of 15 as a symbol only; hence we begin to use the singular verb in the English sentences, — 15 is what part of 50? and, 15 is 50 less?. Yet while this treating of numbers abstractly is essential to progress in arithmetic, considered either as the science of numbers or as the art of computation, we must remember that we study arithmetic not only for culture, but also for utility. In our teaching we must frequently correlate numbers with real facts. This is especially necessary in our dealings with arithmetic as ratio. Our boys and girls must know quarts, yards, pounds, coins, square feet, as actual measures. To encourage interest in arithmetic as truth about real things, pictures and illustrations, tending to stimulate the activity of the imagination which gives men seeing eyes, have been introduced.

Arithmetic is the chief instrument of science and the essence of certainty. It is concrete logic. In a world of flux and change and doubt it is of elemental importance for our boys and girls to know a kind of truth that is as positive as the very reason and the very mind of our humanity.

Author and publishers desire to acknowledge the valuable suggestions of Principal W. B. Gunnison, Ph.D., of Erasmus Hall High School, Brooklyn, N.Y., in reviewing these pages.

W. E. C.

BLOOMFIELD, N.J.,
October 21, 1901.

SUGGESTIONS TO TEACHERS

1. The preface explains the general purpose of the book.

2. Read the book itself. The purposes of certain special features appear only when considered in relation to other features.

3. Do not hesitate to use in advance of the order in the book facts which appear later in these pages.

4. While the purpose of number-study is to learn numbers, oral expression needs to be encouraged. Develop the number-story features of primary work as much as time permits. The reading and the speaking of English sentences where numbers are involved do not interfere with, but rather tend to promote, that rational understanding of number-processes which is the end of Arithmetic as a science.

5. See that the children do study this book, but do not ask them to study quietly over twenty minutes at any one time. Children tire quickly and recover even more quickly.

6. Drill for the sake of instant accuracy; but do not follow any drill to the point of over-fatigue. Take great care not to drill upon things not essential.

7. This book is only a collection of suggestions; it is not an encyclopedia of devices. Seek great variety in methods and devices. There are children who will not learn things in our ways. Try to find their ways of understanding number-facts and number-principles.

8. Every child has peculiar interests. Find them. For number-stories use facts which interest the various children. Remember that children have their "good" and their "bad" days. On their good days children sometimes learn an amazing amount of new matter.

9. A boy or girl may be ready to undertake harder work than this book offers before knowing this book from cover to cover. Yet we should not forget that doing easy things over and over begets confidence, which supports us in our attacks upon new and harder problems.

10. Neatness in writing tends to accuracy in all number-operations. Encourage fine work by commending it.

LESSONS


Tell number stories about
10-4 2+2 2+4 30+5
80-10 6x3 7x7 80+20
Star in fifths and tenths
Names of Months
January
February
March
April
May
June
July
August
September
October
November
December

TELLING NUMBERS AT SIGHT

Number always means number of ones.

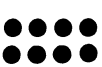
How many ones?

How many ones?

How many twos?

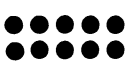
Find twos and threes.

How many ones? Find five and one.
How many threes? Look across.
How many twos? Look up and down.

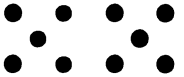


How many twos? Find threes and two.
How many fours? Find five and three.

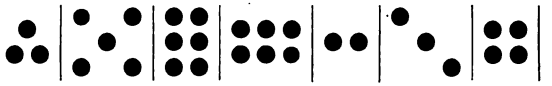
How many threes? Find two fours and one.
Find six and three. Find seven and two.
Find five and four. Find eight and one.



How many twos?
How many fives?



How many?



Counting adds ones, or puts units together.

Adding finds what new number tells all the ones in other numbers taken together.

Subtracting takes a number from another number.

Multiplying adds one number once or several times to itself.

Dividing finds how many times a number contains another.

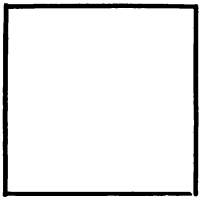
COMPARISONS

Count these dots ● ● ● ● ● and crosses X X X. We cannot add dots and crosses together because they are not the same kind of ones or things.

Count these circles ○ ○ ○ ○ and squares □ □ □ □ □. Can we add circles and squares together? Why not?

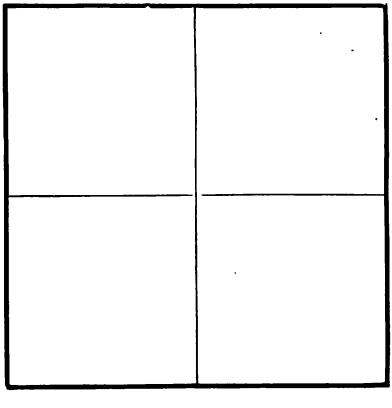
Number always means number of ones of the same kind.

This picture shows one inch square of paper. Draw one square inch on paper.



EACH SIDE IS ONE INCH LONG

But this picture shows two inches square of paper. Draw one square inch on paper, then on the blackboard. How many square inches do you find in this two-inch square picture?



When Mary would like two pieces of red paper, she should tell how large she wishes the pieces to be.

Telling the size or amount or weight is called *measuring.*

We find How many? by counting; and How much? by measuring.

ALL FACTS OF 1 TO 10, IN REVIEW

Additions:

1+1=2	1+6= 7	2+3=5	2+8=10	3+7=10
1+2=3	1+7= 8	2+4=6	3+3= 6	4+4= 8
1+3=4	1+8= 9	2+5=7	3+4= 7	4+5= 9
1+4=5	1+9=10	2+6=8	3+5= 8	4+6=10
1+5=6	2+2= 4	2+7=9	3+6= 9	5+5=10

Subtractions:

10−9=1	9−8=1	8−6=2	7−4=3	5−3=2
10−8=2	9−7=2	8−5=3	6−5=1	4−3=1
10−7=3	9−6=3	8−4=4	6−4=2	4−2=2
10−6=4	9−5=4	7−6=1	6−3=3	3−2=1
10−5=5	8−7=1	7−5=2	5−4=1	2−1=1

Multiplications:

2×2=4	2×3=6	2×4=8	2×5=10	3×3=9

Divisions:

10÷5=2	8÷4=2	9÷3=3	6÷3=2	4÷2=2

QUESTIONS

1. How many are 5+5?
2. How many are 10−5?
3. How many 5's in 10?
4. How many 2's in 10?
5. How many are 9−6?
6. How many 3's in 9?
7. How many are 8−4?
8. How many 4's in 8?
9. How many are 2+7?
10. How many 3's in 6?

\+ means *and*, − means *less*, × means *times*,

9÷3 means, How many 3's are there in 9?

+, −, ×, and ÷ are called **Signs.**

TEN, 10

We always count by ones. We say that one and one are two, two and one are three, ten and one are eleven, twenty and one are twenty-one. If we would like to add three apples and two apples, we must know that we are counting three ones and two ones; we must know that three and one are four, four and one are five.

Until we reach the number **ten**, each number has one figure as its sign. The sign of one is 1, of five is 5, of nine is 9. But when we reach the number ten, we find a number which has two figures as its sign. The sign of ten is 10. In this sign 10 are the figure 1 and the figure 0, called zero. This 0, or zero, with a figure before it at the left as we look at it, shows that the figure means ten times the number of ones for which it stands when it has no 0, or zero, after it.

10 means 1 ten, 20 means 2 tens, 50 means 5 tens.

 are 1 ten, or 10, ten.

 are 2 tens, or 20, twenty.

All these dots together are 3 tens, or 30, thirty.

Whenever a number has two figures, the figure to the left of the zero tells how many tens are meant.

Add 1
6  =

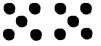
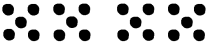
Add 10
6  =

sixteen 16

NUMBER-NAMES ABOVE TEN

We call ten and one, eleven; ten and two, twelve. Most number-names for more than twelve things are names made of the single number-names from one to twelve. We call ten and three, thirteen, which is very much like three-ten. Four and ten are fourteen; five and ten, fifteen; six and ten, sixteen; seven and ten, seventeen; eight and ten, eighteen; and nine and ten are nineteen.

Read these numbers: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.

 are ten.  are two tens.

Two fives we call ten. Two tens we call twenty.

A great many years ago people called two tens, twain tens; then they used to call two twain.

Twenty and one we call twenty-one; twenty and two, twenty-two; twenty and three, twenty-three; then we have twenty-four, twenty-five, twenty-six, twenty-seven, twenty-eight, and twenty-nine.

Give the names for these numbers: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29.

Read these numbers: 25, 24, 26, 28, 22, 27, 21, 29, 20.

Three tens we call thirty. Three tens and one we call thirty-one. Four tens we call forty. Fifty means five tens. Sixty, six tens. Seventy, seven tens. Eighty, eight tens. Ninety means nine tens.

We have another name for ten tens, one hundred.

10 ten	16 sixteen	30 thirty	90 ninety
11 eleven	17 seventeen	40 forty	90 + 1 = 91
12 twelve	18 eighteen	50 fifty	90 + 3 = 93
13 thirteen	19 nineteen	60 sixty	90 + 5 = 95
14 fourteen	20 twenty	70 seventy	90 + 8 = 98
15 fifteen	21 twenty-one	80 eighty	100 one hundred

COUNTING

Count by twos, beginning at 2.

2	4	6	8	10	12	14	16	18	20
22	24	26	28	30	32	34	36	38	40
42	44	46	48	50	52	54	56	58	60
62	64	66	68	70	72	74	76	78	80
82	84	86	88	90	92	94	96	98	100

These are called the **even** numbers. 2 divides each number without a one left.

Count backwards, beginning at 100.

Count by twos, beginning at 1.

1	3	5	7	9	11	13	15	17	19
21	23	25	27	29	31	33	35	37	39
41	43	45	47	49	51	53	55	57	59
61	63	65	67	69	71	73	75	77	79
81	83	85	87	89	91	93	95	97	99

These are called the **odd** numbers. 2 divides no number evenly. One is always left over.

Count backwards, beginning at 99.

Count by threes, beginning at 3: then backwards.

3	6	9	12	15	18	21	24	27	30	33
36	39	42	45	48	51	54	57	60	63	66
69	72	75	78	81	84	87	90	93	96	99

Count by fives, beginning at 5: then backwards.

5	10	15	20	25	30	35	40	45	50
55	60	65	70	75	80	85	90	95	100

Count by sevens, beginning at 7: then backwards.

7	14	21	28	35	42	49
56	63	70	77	84	91	98

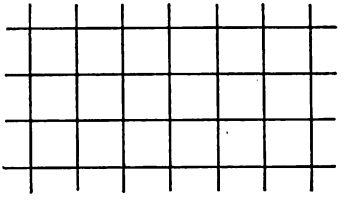
THINGS TO DO

1. Count all the boys in the room, giving them *odd* numbers, and all the girls, giving them *even* numbers. How many are there in all? Can each boy and girl remember the number given to him or to her?

2. Cut out about thirty squares of paper. Write the numbers to thirty, one number on each square.

3. Cut each square into two pieces, and using the other side of the paper, number each of the pieces.

4. Draw lines like these, but longer, so as to make more squares, and number each of the squares. Cut the squares apart.



5. Count the number of panes of glass in all the window sashes of the classroom.

6. Count the number of desks in the room, and then the number of chairs. Write each number for the desks upon a piece of paper, and place it on the desk to which it belongs.

7. Count marbles, shoes, hands, fingers, hats, caps, pencils, splints, blocks, and other objects, as far as one hundred.

8. Read the numbers of the pages of this book as far as one hundred.

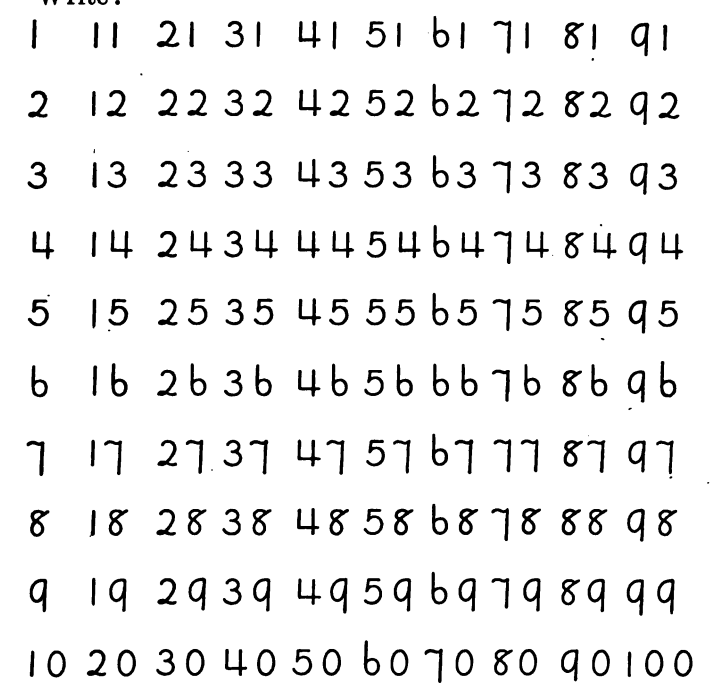
9. Count the number of lines of print upon this page.

10. Write the number of the house where you live.

11. How many chickens, or sparrows, or ducks, or cows, or horses, did you ever count together at one time?

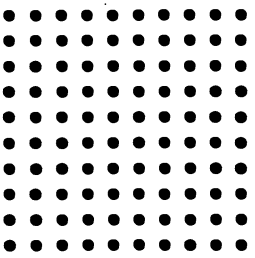
NUMBER TABLE

Write:



1. Write ten, eleven, twelve, thirteen, fourteen, fifteen.
2. Write sixteen, seventeen, eighteen, nineteen, twenty.
3. Write twenty-one, twenty-two, twenty-three, twenty-four.
   21 22 23 24
4. Write twenty-five, twenty-six, twenty-seven, twenty-eight.
   25 26 27 28
5. Write twenty-nine, thirty, forty, fifty, sixty, seventy.
   29 30 40 50 60 70
6. Write eighty, ninety, one hundred, one hundred one.
   80 90 100 101

THINGS TO DO



We can use instead of dots:
circles like this ○, or
crosses like this ×, or
signs like this +, or
triangles like this △, or
squares like this □, or
any forms, such as these, —

1. Make 100 dots on paper or on blackboard.

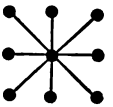
2. Number these dots or squares 1, 2, 3, etc., like this $\underset{1}{\bullet}$ or this $\underset{1}{\square}$.

3. Make lines around every 2 dots like this, 

4. Make lines around every 3 dots,  or 

5. Make lines around every 4 dots, every 5 dots, every 6 dots, every 7 dots, every 8 dots, every 9 dots.

6. Connect every dot with all the dots next to it, like this, —



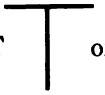
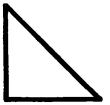
7. Use red chalk or pencil and mark every alternate dot which has an even number, like this $\underline{\bullet}$ or this ⊙.

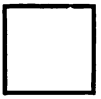
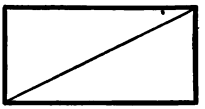
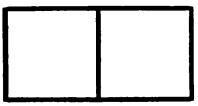
8. Use blue chalk or pencil and mark every alternate dot which has an odd number, like this $\underline{\bullet}$ or this ⊙.

9. Mark with blue, or yellow, or red chalk every third, every fourth, every fifth, every sixth dot, etc.

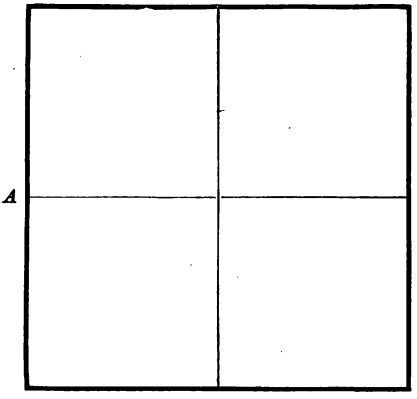
Use new sets of •, or □, or + tables except for 1 and 2.

FORM

With a stick, or a splint, or a pencil, we can represent a line ——— across, or | up and down, or / slanting up to the right, or \ down to the right. With two sticks we can make a cross  or a T  or an angle like this  or this  or this  Try and see. With three sticks we can make a form like this  It is called a triangle because it has three angles. 

With four sticks each of the same length, we can make squares like this  If we have a pair of sticks of the same length, and another pair of sticks longer than the others, two like these ═══, and two like these ═══, we can make a rectangle like this  If we draw a line through our rectangle to opposite corners, we have two triangles inside the rectangle. If we  have the longer sides twice as long as the shorter sides, then inside our rectangle we have two squares. 

PARTS OF FORMS

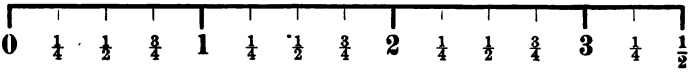


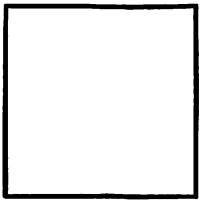
How many little squares do you find in this large square?

This square is two inches wide and two inches high.

When things are exactly like each other in size, we call them **equal.** If you find inside of the square *A* four squares each of the same size, then all four parts of *A* are equal parts.

MEASURE MARKED IN INCHES





Is this square as large as the square marked *A*? Is it as large as any part of *A* square?

Measure this square *B*, using a ruler marked with inches; cut a square out of paper of the same size as *B*, and see how many little squares as large as *B* you find in *A* square.

If you find that square *A* is four times as large as the square marked *B*, then it is right to say that *B* is one fourth as large as *A*.

If *A* is four times *B*, then *B* is one fourth of A.

If *A* is $4 \times B$, then *B* is $\frac{1}{4}$ of *A*.

EQUAL PARTS OR FRACTIONS

A *number* is always a number of *ones* of the same kind.

A *fraction* is always one or more of the equal parts of some *one* thing.

Here are four forms, *A*, *B*, *C*, and *D*.

Each is of a different size from the others.

A is divided into five parts. *B* is divided into four parts.

C is divided into two parts. *D* is not divided.

Each part of *A*, each part of *B*, and each part of *C* is the exact size of *D*.

There are 5 *D*'s in *A*. Count and see.

There are 4 *D*'s in *B*, and 2 *D*'s in *C*.

Each part of *A* is equal to every other part. The five parts are equal.

Each part of *B* is equal to every other part. The four parts are equal.

One part of *C* is equal to the other part.

We call equal parts fractions.

Each part of *A* is a fraction of *A*. There are five parts.

Each part of *A* is one fifth part of *A*. We print this, $\frac{1}{5}$.

The 1 above the 5 means that we are taking one part.

The 5 means that there are five equal parts in *A*.

Each part of *B* is a fraction of *B*. There are four parts.

Each part of *B* is one fourth of *B*. We print this, $\frac{1}{4}$.

The 1 above the 4 means that we are taking one part.

The 4 means that there are four equal parts in *B*.

Each part of *C* is a fraction of *C*. There are two parts.

Each part of *C* is one half of *C*. We print this, $\frac{1}{2}$.

REVIEW

Can you tell what number separates the numbers in these questions, 1 to 9, below?

1. 5–8–11–14.
2. 5–9–13–17.
3. 8–12–16–20.
4. 8–13–18–23.
5. 11–17–23–29.
6. 10–17–24–31.
7. 10–20–30–40.
8. 6–15–24–33.
9. 5–13–21–29.

10. Write on the blackboard five times without commas and period:

1 2 3 4 5 6 7 8 9 0 9 8 7 6 5 4 3 2 1

11. Write on the blackboard five times these numbers:

10, 12, 23, 34, 45, 56, 67, 78, 89, 90.

12. Write on the blackboard five times these numbers:

135, 246, 579, 680, 258, 813, 490.

M

The rectangle is not divided into equal parts.

O	O

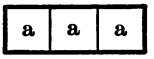
The rectangle is divided into two equal parts.
Each part is one half the whole rectangle.

S	S	S

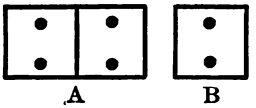
The rectangle is now divided into three equal parts.
Each part is one third the whole rectangle.
O is $\frac{1}{2}$, one half, of *M*, for there are 2 *O*'s in *M*.
S is $\frac{1}{3}$, one third, of *M*. Why?

PARTS OF NUMBERS

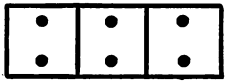
What part of A is a? $B = a$. B is one half of A. A equals 2 B's. $B = \frac{A}{2}$.



What part of C is a? $C = 3$ B's. B is one third of C. $a = \frac{1}{3}$ of C.



How many dots do you find in B? How many dots do you find in A?

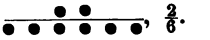


$4 = 2 \times 2$. 4 are twice two.

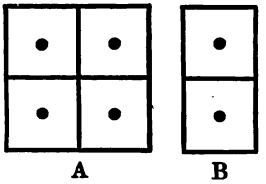
$2 = \frac{1}{2}$ of 4. One half of four is two.

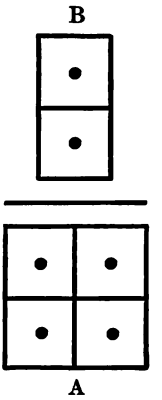
$6 = 2 \times 3$. We find 3 2's in C. $B = \frac{1}{3}$ of C.

$2 = \frac{1}{3}$ of 6. One third of six is two.



These are pictures of the two fractions $\frac{1}{2}$ and $\frac{2}{4}$. We call the picture-fractions $\frac{1}{2}$, one half, when we think that $A = 2$ B's. Then B is only $\frac{1}{2}$ of A.



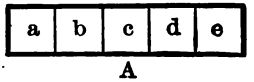


We call the picture-fractions $\frac{2}{4}$, two fourths, when we think that A's 4 dots $= 2 \times B$'s 2 dots. B is $\frac{2}{4}$ of A. $\frac{1}{2}$ is the same amount of value as $\frac{2}{4}$.

PARTS

Cut out of paper a square one inch on each side.
Then cut out a rectangle two inches long, one inch high.
The square is one half as large as the rectangle.
Cut the square into two equal parts, one inch by $\frac{1}{2}$ inch.
Cut the rectangle into four equal parts.
Do you see that the 2 parts of the square are $\frac{2}{4}$ of the rectangle?

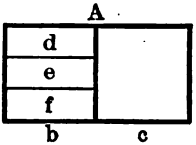
There are 5 equal parts in A. Each is $\frac{1}{5}$ of A.



A

$a + b = 2$ fractions of $A = \frac{2}{5}$ of A.
$a + b + c = 3$ fractions of $A = \frac{3}{5}$ of A.
$a + b + c + d = 4$ fractions of $A = \frac{4}{5}$ of A.
$a + b + c + d + e = 5$ fractions of $A = \frac{5}{5}$ of A.

But as there are only 5 parts in A, $\frac{5}{5}$ of A = all of A = 1 A.



This form-picture is divided into two parts, $b + c$. $b = \frac{1}{2}$ of A. $c = \frac{1}{2}$ of A.
The picture of b is divided into three parts, d, e, f. $d = \frac{1}{3}$ of b. $e = \frac{1}{3}$ of b. $f = \frac{1}{3}$ of b.

If we divide c into three parts, then A will have 6 parts.
If A has 6 parts, then $d = \frac{1}{6}$ of A.
$d = \frac{1}{3}$ of $\frac{1}{2}$ of A, because d is $\frac{1}{3}$ of b, which is $\frac{1}{2}$ of A.

1. $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} = ?$
2. $\frac{1}{6} + \frac{1}{6} + \frac{2}{6} + \frac{2}{6} = ?$
3. $\frac{1}{3} + \frac{1}{6} = ?$
4. $\frac{1}{5} + \frac{2}{5} + \frac{2}{5} = ?$
5. $\frac{1}{2} + \frac{1}{2} = ?$
6. $\frac{1}{3} - \frac{1}{6} = ?$

Cut and fold pieces of paper to show the answers to these six questions.

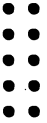
PARTS OF NUMBERS

5 names	5 |'s	5 = |||||	1 = $\frac{1}{5}$ of 5
3 names	3 |'s	3 = |||	1 = $\frac{1}{3}$ of 3
4 names	4 |'s	4 = ||||	1 = $\frac{1}{4}$ of 4
2 names	2 |'s	2 = ||	2 = $\frac{1}{2}$ of 2

When we say one fifth of anything, we mean that the thing is divided into fifth parts, into five equal parts, and that we are talking about one of these parts.

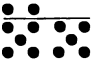
When we say one fifth of any number, we mean that the number is divided into fifth parts, into five equal parts, and that we are talking about one of these parts.

Here is a picture of the number ten seen in dots.



There are 2 rows up and down of 5 dots each. The 10 is divided into 2 equal parts of 5 each.

There are also 5 rows across of 2 dots each. The 10 dots are divided into 5 equal parts of 2 dots each.

We can say that  (2 dots) are  of 10 dots, or $\frac{2}{10}$.

$2 \times 5 = 10$ $\quad 2 = 10 \div 5$ $\quad 2$ is $\frac{1}{5}$ of 10 $\quad 2 = \frac{10}{5}$

We can say that  are  (10) of 10.

$5 \times 2 = 10$ $\quad 5 = 10 \div 2$ $\quad 5$ is $\frac{1}{2}$ of 10 $\quad 5 = \frac{10}{2}$

1. Add:

8	4	1	2	1	9	7	4	1	3
2	5	9	8	7	1	3	6	5	4

2. Add:

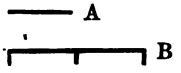
2	5	3	2	4	3	4	2	1	5
7	2	3	2	1	5	3	6	1	4

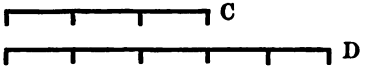
PARTS OF NUMBERS

Sometimes we take things apart. We split a piece of wood into separate pieces; we cut an apple in two; we spend a quarter of a dollar, which is a part of a dollar.

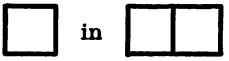
When we make two equal parts of anything, we call each part one half. The figures for one half are $\frac{1}{2}$.

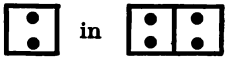
When we make three equal parts, we call each part one third : $\frac{1}{3}$. Each part of four equal parts is one fourth, or one quarter : $\frac{1}{4}$. After these we have one fifth : $\frac{1}{5}$.

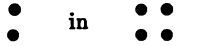




B has 2 *A*'s.	$A = \frac{1}{2}\ B$.	Measure these lines
C has 3 *A*'s.	$A = \frac{1}{3}\ B$.	and see if these stories
D has 5 *A*'s.	$A = \frac{1}{5}\ B$.	are true.

We can take parts of form-pictures. 

We can take parts of number-pictures. 

We can take parts of numbers. 

We can tell parts by figures. 2 in 4

When the parts of anything are equal to each other, then we call the equal parts fractions.

There are ten ones in ten. There are three ones in three.

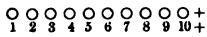
Three are three tenths of ten. $3 = \frac{3}{10}$ of 10. 

1	2	3	4	5	6	7	8	9	10

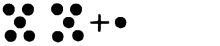
If each of these tenths of the whole figure is $\frac{1}{4}$ inch long, how long are $\frac{4}{10}$ of it?

ELEVEN, 11

If we have ten things and add one thing to them, the name of the number of all these things together is **eleven.**



10 + 1 are eleven.



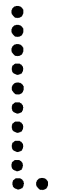
Ten and one are eleven.

$$\begin{array}{r} 10 \\ 1 \\ \hline 11 \end{array}$$

We write eleven with the figure 1 twice: 11.

In the figures 11 for eleven, the unit one, 1, has the place of the zero, 0, in the figures 1 and 0, printed like this: 10, for the number ten.

In the number eleven, printed as 11, the second 1 shows that the first 1 stands not for one, 1, unit, but for one ten, or 10. 11 means 1 ten and 1 unit, like this group of dots:



8+3=11 7+4=11 6+5=11 11−5=6

10+1=11 9+1+1=11 5+5+1=11 2+3+5+1=11

11−1=10 11−2= 9 9+2=11 7+2+2=11

With splints and counters, show each of the above facts.

1. John had five cents and Tom had six cents. How many cents did they have together?

2. There were ten boys; one of them had two cents, nine of them had each one cent. How many cents did they have together?

3. Mary had eleven cents. She spent four for apples at one cent each. How many cents were left?

4. Tell number-stories about cents, using these number-facts: 11−1, 5+2+4, 10+1, 9+2, 4+7, 11−6, 8+3.

5. Add:

$$\begin{array}{rrrrr} 10 & 3 & 6 & 9 & 7 \\ \underline{1} & \underline{8} & \underline{5} & \underline{2} & \underline{4} \end{array}$$

6. Subtract:

$$\begin{array}{rrrrr} 11 & 11 & 11 & 11 & 11 \\ \underline{1} & \underline{3} & \underline{5} & \underline{2} & \underline{7} \end{array}$$

MEANING OF SIGNS

The sign of multiplication is $\times$; it means *times*.
The sign of division is $\div$; it means *divided by*.
? asks a question. It is called *the question mark*.

1. When we ask $10 \div 1 = ?$, what does the $\div$ mean?
2. What is the answer to $10 \div 2 = ?$
3. What does this . mean? What is its name?
4. What is the name of this mark ,?
5. What does this mark + mean? And this −?
6. Read these questions in words:

$3 \times 3 = ?$ $11 = 3 \times ?$ and how many over? $6 + 5 = ?$
$11 - 9 = ?$ $8 + ? = 11?$ $11 - 4 = ?$ $3+3+2+1+?=11.$

ELEVEN

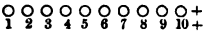
7. Is eleven an odd or an even number? Why?
8. What is the next number after 10? before 10?
9. How many more are 11 than 10 things?
10. George had eleven marbles and Charlie had 8. Which had more than the other? How many more did he have?
11. Take 11 splints. Make 2 squares with them and one triangle.
12. How many triangles can you make with eleven splints? How many splints are left over?
13. Add:

3	2	5	3	6	4	6	5	6
6	3	4	7	4	4	3	5	2

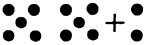
14. Can you remember several numbers when written on the board and then quickly erased? Try and see.

TWELVE, 12

If we have ten things and add two things to them, the name of the number of all these things together is **twelve.**



10 + 2 are twelve.



Ten and two are twelve.

$$\begin{array}{r} 10 \\ 2 \\ \hline 12 \end{array}$$

We write twelve with the figures 1 and 2: 12.

In the figures 12 for twelve, the unit two or figure 2 has the place of the zero, 0, in the figures 10, for the number ten. In the number twelve, printed as 12, the figure 2 shows that the figure 1 stands not for one unit, but for one ten or 10.

12 means 1 ten and 2 units, like this group of dots:

In the numbers eleven and twelve, printed 11 and 12, we say that the 1 in each number where it is the first figure, reading from left to right, is in *tens'* place and that the second figure in each number is in *units'* place.

12 things make one dozen.

When we say, "Mary's mother who keeps hens sent Mary with a dozen eggs to sell to the grocer," we mean that Mary carried twelve eggs.

$10 + 2 = 12$ $\quad 9 + 3 = 12$ $\quad 8 + 4 = 12$ $\quad 7 + 5 = 12$

$12 - 6 = 6$ $\quad 12 - 7 = 5$ $\quad 12 - 10 = 2$ $\quad 12 - 9 = 3$

Show each of these facts with counters and dots.

1. Tell number-stories about cents, or eggs, or marbles.

2. Mary has seven dozen eggs and Susan has five dozen. How many dozen have they together?

CENTS, NICKELS, AND DIMES

Our smallest coin is worth 1 cent. The sign, 1 ¢

1 nickel is worth 5 cents. We can write nickel, 5 ¢

1 dime is worth 10 cents. We can write dime, 10 ¢

1. Grace bought half a dozen of cookies at 1 ¢ apiece. She gave the baker a dime. What change did he give her?

2. I paid a nickel for half a dozen pens. How many cents would a dozen pens have cost?

3. 10 cents are worth 1 dime. Why? 2 nickels are worth 1 dime. Why?

4. Which would you rather have, a dozen cents or a dime?

5. It usually costs 5 ¢ for a man to ride on the street cars, and 3 cents for a boy. How many men can ride for a dime? How many boys can ride for a dozen cents?

6. Did you ever see a pile of a dozen cents?

7. Write on the blackboard a story about cents, nickels, and dimes.

OTHER NUMBERS

2+7=?	5+3=?	6+2=?	7−4=?	3+6=?
3+7=?	7−5=?	9−4=?	9−6=?	10−9=?
7+3=?	9−2=?	1+9=?	9−1=?	7+2=?
6+4=?	10−3=?	4+4=?	7−4=?	8−6=?
9+1=?	10−4=?	4−3=?	5+5=?	10−2=?
9−5=?	10−5=?	4−6=?	10−8=?	2+8=?
10−1=?	8+2=?	1+1=?	5+1=?	5−2=?
7=3+?	10=5+?	3=2+?	10=8+?	5=3+?

DIVIDING AND MULTIPLYING

$12 = 6 + 6$ $\quad 6 \times 2 = 12$ $\quad 12 \div 2 = 6$

Add 6 Subtract 12

6 6

1. How many are $4 + 4 + 4$? $3 \times 4 = ?$
2. How many are $3 + 3 + 3 + 3$? $4 \times 3 = ?$
3. In 1 above how many 4's do you count?
4. In 2 above how many 3's do you count?
5. Show 1 and 2 by splints, counters, pennies, or dots.
6. Is it true that $3 \times 4 = 12$ and $4 \times 3 = 12$?

When we find how many fours there are in twelve, we count 4's until we reach 12. $4 + 4$ are 8. $8 + 4$ are 12. There are three fours in twelve. Multiplying, or finding one number times another, is rapidly adding one number to itself. Dividing, or finding how many times one number contains another, is rapidly taking away the same number several times from another number.

$12 \div 4 = 3$. We find three fours in twelve.

NUMBER-STORIES

7. Charlie had twelve apples; and when four boys came to see him, he wanted to give each of them the same number. How many could he give to each?

8. There were two boys who had six marbles each. How many did they have together?

9. Lulu had an afternoon tea-party. Her mother gave her a dozen tea-biscuits. She and Clara and Mabel ate them all; each ate as many as the others. How many did each eat?

MULTIPLYING AND DIVIDING

1. When we ask $5 \times 2 = ?$, what does the $\times$ mean? And what does the $=$ mean? And what does the ? mean?

2. What is the answer to $5 \times 2 = ?$

$1 + 1 = 2$; or there are two 1's in 2;
or $1 \times 2 = 2$; or $2 \times 1 = 2$.

3. $1 + 1 + 1 = 3$; or there are three 1's in 3;
or $1 \times 3 = 3$; or $3 \times 1 = 3$.

4. — is the *dash* or *blank* mark. Can you fill in the words or numbers that are left out as shown by the dashes?

In 5 there are — 1's; or $5 \times 1 = —$.
4 apples at 1¢ apiece will cost — cents.
In 6 there are — 1's; or $6 \times 1 = —$.
In 7 there are — 1's; or $7 \times 1 = —$.

5. $1 + 1 + 1 + 1 = 4$; or four 1's $= 4$; or there are four 1's in 4; or 4 times 1 are 4; or $4 \times 1 = 4$.

$2 + 2 + 2 + 2 = 8$; or 4 2's $= 8$; or there are four 2's in 8.

6.

$2 \times 2 = ?$	$2 \times 5 = ?$	$5 \times 2 = ?$	$5 \div 2 = ?$
$5 \div 3 = ?$	$8 \div 4 = ?$	$4 \times 2 = ?$	$5 \times 2 = ?$
$10 \div 2 = ?$	$10 = 5 \times ?$	$8 = 2 \times ?$	$3 \times ? = 9$
$9 \div 3 = ?$	$9 \div 5 = ? + ?$	$7 \div 3 = ? + ?$	$6 \div 3 = ?$
$12 \div 3 = ?$	$12 \div 5 = ? + ?$	$12 \div 4 = ?$	$11 \div 3 = ? + ?$

A dozen cents less a dime = how many cents?

7. $1 + 1 + 1 = 3$; or three 1's $= 3$; or $3 \times 1 = 3$.
$2 + 2 + 2 = 6$; or three 2's $= 6$; or $3 \times 2 = 6$.
$3 + 3 + 3 = 9$; or three 3's $= 9$; or $3 \times 3 = 9$.

REVIEW

1. Subtract:

5	7	9	8	10	10	6	10
2	3	5	6	4	9	3	1

2. Subtract:

10	8	10	7	8	10	9	6
3	5	5	2	4	6	4	2

3. Subtract:

10	9	7	4	6	8	6	8
8	6	4	3	5	3	1	2

4. Add:

5	6	2	9	1
7	6	10	3	11

5. Subtract:

12	12	12	12	12
7	2	3	6	1

6. Copy and answer:

$8-?=5$	$10=6+?$	$10=3+?$	$7+?=9$	$6-?=2$
$5+?=10$	$10=7+?$	$10=4+?$	$10-7=?$	$10-2=?$
$7=3+?$	$4+?=10$	$3+?=10$	$8+?=10$	$7-1=?$
$1+?=10$	$6+?=8$	$10-?=7$	$10-?=4$	$2-?=5$
$7+?=10$	$9-?=4$	$5-?=2$	$6=?+4$	$10-?=4$

Write in words your answers to these next two questions:

7. Two boys had 5 cents each. Another boy had 2 cents. If they had put them all together, and had then divided them equally, how many would each have had?

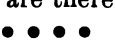
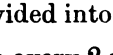
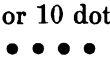
8. They did not do this, but when still another boy joined them, they bought for one cent apiece as many doughnuts at the bakery as they had cents, and divided the brown doughnuts equally, as many to one as to another. How many doughnuts did each have?

9. Tell stories about $12-6$, $6+6$, $4+4+4$, and 6×2.

DIVIDING

Often we write division-questions in this way $2\overline{)10}$ This means just the same as $10 \div 2 = 5$. $\frac{5}{}$

We may read $2\overline{)10}$ either 10 divided by 2 are how many? or how many 2's are there in 10?

Here are ten dots  We can show that we may think of them as divided into 5×2 dots or 10 dots $\div 5$ by drawing lines between every 2 dots  or as divided into 2×5 dots or 10 dots $\div 2$ by drawing a line between every 5 dots 

Dividing is the opposite of multiplying.

Dividing is taking numbers apart; multiplying is putting numbers together.

SOMETHING TO DO

1. Take 12 splints or counters. Separate them into one bunch of 6 and another bunch of 6. This is dividing 12 splints by 2. How would you divide 12 splints by 6?

2. Take the 2 bunches, each of 6 splints, and put them together. This is multiplying 6 splints by 2. What would you do to multiply 2 splints by 6?

3. $12 \div 3 = ?$ $12 \div 4 = ?$ $3 \times 4 = ?$ $4 \times 3 = ?$

Answer these questions by dots or counters.

4. $2\overline{)4}$ $2\overline{)6}$ $2\overline{)8}$ $2\overline{)10}$ $2\overline{)12}$ $3\overline{)6}$ $3\overline{)9}$ $3\overline{)12}$ $4\overline{)8}$ $4\overline{)12}$

5. A grocer sold half a bushel of onions. What part of the bushel did he have left?

6. One half of 6 splints = how many splints?

DIVIDING WITH A NUMBER OVER

1. Find 3's in 7. $2 \times 3 = 6$ $6 + 1 = 7$ $7 \div 3 = (3 \times 2) + 1$. 7 divided by 3 are 2 and 1 over.

2. Find 4's in 11. $2 \times 4 = 8$ $8 + 3 = 11$ $11 \div 4 = (4 \times 2) + 3$.

3. How much is $12 \div 5$? 12 divided by 5 are 2 and 2 over.

4. $5\overline{)11}$. Five is found in 11 twice and 1 over. $5\overline{)11} + 1$.

5. $7\overline{)12}$ $7\overline{)12} + 5$ **6.** $3\overline{)10}$ $2\overline{)9}$ $4\overline{)9}$ $10 \div 6 = ?$

7. $12 \div 10 = ?$ $8 \div 5 = ?$ $9 \div 8 = ?$ $12 \div 9 = ?$

When you see these marks ( ), called *parenthesis* marks, around numbers, they mean that we must do first what the sign inside says: $(3 \times 2) + 2 = ?$ means 3×2, which are 6, then add $2 = ?$ The answer is 8. But the answer to $3 \times (2 + 2)$ is $3 \times 4 = 12$.

REVIEW

8. If I owe you 4¢, and give you a dime, how many cents must you give me back?

9. A piece of ice weighed 10 pounds in the morning. In the evening it weighed 2 pounds less. What was its weight in the evening?

10. Harry bought a bottle of ink for 3¢, a pencil for 1¢. He gave the clerk a nickel. Should the clerk give him any change?

11. Make a story about 3 and 4; about 2 and 5; about 6 less 1; about 3 and 1 and 2; about $12 \div 6$; about $11 \div 5$; $10 \div 4$.

QUESTIONS

1. How many two-cent stamps can we buy for a dime? How many can we buy for a dozen pennies?

2. Frank is 10 years old. His brother is 4 years younger. How old is his brother?

3. Edgar has a dime. Willie has a nickel and 3¢. How many more cents has Edgar than Willie?

4. George earned a nickel on Saturday forenoon and another nickel in the afternoon. On Saturday evening he spent 6¢. How many cents had he left?

5. A post was 10 feet high. 2 feet of it were in the ground. How many feet were above the ground? If Tom is 4 feet tall, how much higher is the post?

6. I buy an orange for 3¢ and hand the fruit-dealer a dime. What change should he give me?

7. There were 10 plum trees in an orchard. 2 of them died. How many lived? How many more would the farmer need to plant so as to have a dozen in all?

8. Arthur gave a dime for a flag and a top. The top cost 4¢. How much did the flag cost?

9. George gave 3 apples to each of 4 boys. How many did he give in all?

10. Alice had 10 pansies. She gave away 3 of them. How many had she left? If she divided the number left among three friends, giving each two, would she then have any pansies for herself?

11. Her father gave Helen a dime. She bought 5¢ worth of braid. How many cents had she left?

12. Louis spelled 3 words and James spelled 4. How many words did both boys spell?

TWOS

1 2 3 **4** 5 **6** 7 **8** 9 **10** 11 **12**
13 **14** 15 **16** 17 **18** 19 **20** 21 **22** 23 **24**

$0 + 2 = 2$ $6 + 2 = 8$ $12 + 2 = 14$ $18 + 2 = 20$
$2 + 2 = 4$ $8 + 2 = 10$ $14 + 2 = 16$ $20 + 2 = 22$
$4 + 2 = 6$ $10 + 2 = 12$ $16 + 2 = 18$ $22 + 2 = 24$

Show by counters that each of these facts is true.

$2 \times 1 = 2$	$2 \times 7 = 14$
$2 \times 2 = 4$	$2 \times 8 = 16$
$2 \times 3 = 6$	$2 \times 9 = 18$
$2 \times 4 = 8$	$2 \times 10 = 20$
$2 \times 5 = 10$	$2 \times 11 = 22$
$2 \times 6 = 12$	$2 \times 12 = 24$

MULTIPLICATION TABLE OF TWOS

We read it either this way, 2 2's are 4, or two times two are four; two 3's are 6, or two times three are six; and so on.

$6 + 6 = 12$ two 6's = six 2's $2 + 2 + 2 + 2 + 2 + 2 = 12$

$10 + 10 = 20$ two 10's = ten 2's

$2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 20$

1. Copy the Table of Twos on paper.

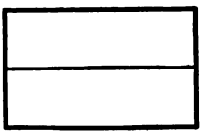
2. Count by 2's to 24. Write this counting.

3. Show that two 5's are 10, two 9's are 18, two 12's are 24.

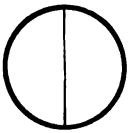
4. Show that two 4's are 8, two 7's are 14, two 11's are 22.

HALVES

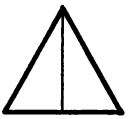
When anything is divided into two equal parts, each part is called a half. Two halves make a whole.



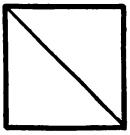
Rectangle in halves



Circle in halves



Triangle in halves



Square in halves

When anything is divided into two equal parts, the parts are called halves.

Draw a line 2 inches long. Divide it into halves.

Draw a square. Divide it into halves.

One half is written ½ in figures.

1. How many halves are there in one dollar?

2. How many halves are there in a pie? If a pie cost 10 cents, how much will half a pie cost?

3. James had one dollar. He spent half a dollar for a ball. How much money had he left?

4. If you bought a cookie and ate half of it, how much of it would be left? Would the part of it left be equal to the part you ate?

5. One orange is what part of two oranges?

6. One basket is what part of two baskets?

7. One half of two cents is how much?

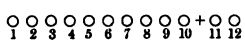
8. One half of four cents is how many cents?

9. George earned ten cents by doing errands. He gave half of the money to his sister. How many cents did he give to her?

10. ½ of 10 cents is how many cents?

THIRTEEN, 13

When we have ten things and add three things to them, the name of the number of all these things together is **thirteen.**



$$\begin{array}{r} 10 \\ 3 \\ \hline 13 \end{array}$$

10 + 3 are thirteen. Ten and three are thirteen.

We write thirteen with the figures 1 and 3, 13. We put 1 in tens' place, and 3 in units' place. 13 means 1 ten and 3 units, like these dots :

12 + 1 = 13. A dozen and one are thirteen.

Thirteen is the first name of a number which is made up with the thought of ten as one part of the name. All names of numbers above thirteen as high as ninety-nine have at least a **t** in them to make us remember ten.

Show by splints that each of these number-facts is true: 11+2=13, 13−4=9, 13−6=7, 8+5=13, 13−10=3.

1. When your fathers and mothers were little boys and girls, thirteen was called the "baker's dozen," because the bakers gave them not twelve but thirteen biscuits or rolls when asked for a dozen. How many more did they give than the bakers give now for a dozen?

2. A hen sat for three weeks on thirteen eggs and eleven little chickens came out of their shells one day. The day after the other eggs had little chickens peep out. How many chickens came out of their shells the second day?

3. Tell number-stories about these facts: 10+3, 13−5, 11 + 2, 6 + 7, 13 − 9, 1 + 2 + 3 + 7, 12 + 1.

4. Add: 12 11 9 6 5
1 2 4 7 8

5 Subtract: 13 13 13 13 13
2 4 6 8 10

1 TO 13

1. One half is a *fraction*.

This  is 2 times this 

INCH HALF INCH

A fraction is one or more of the equal parts of a thing.

2. $\frac{1}{2}$ of $4¢ = ?$ $\frac{1}{2}$ of $4 = ?$ $\frac{1}{2}$ of $9 = ? + ?$

$\frac{1}{2}$ of $12¢ = ?$ $\frac{1}{2}$ of $12 = ?$ $\frac{1}{2}$ of $11 = ? + ?$

$\frac{1}{2}$ of $10 = ?$ $\frac{1}{2}$ of $6 = ?$ $\frac{1}{2}$ of $2 = ?$

$\frac{1}{2}$ of $8 = ?$ $\frac{1}{2}$ of $6¢ = ?$ $\frac{1}{2}$ of $8¢ = ?$

3. $10-2=?$ $7+?=10$ $10-7=?$ $9\div 3=?$

$3+?=13$ $11-3=?$ $6+?=10$ $6+?=13$

$10-6=?$ $4+?=10$ $13-4=?$ $10+1=?$

$5+?=12$ $10-5=?$ $8+?=10$ $7\div 2=?+?$

$10-8=?$ $4+?=10$ $10-4=?$ $9\div 5=?+?$

$9+?=10$ $10-9=?$ $2)\underline{13}$ $3)\underline{13}$ $12\div 10=?$

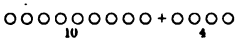
4. Add:

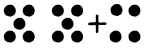
1	4	3	1	8	5	4	6	
2	1	3	5	1	2	3	2	
3	1	2	2	1	3	4	5	
2	2	3	5	2	6	5	3	4
9	4	4	3	2	3	2	9	4
1	1	2	1	2	1	3	1	5
6	5	2	3	1	7	1	2	4
2	3	5	3	1	2	6	5	1
2	2	1	3	1	1	1	1	4

5. What is $\frac{1}{2}$ of 2, of 4, of 6, of 8, of 10, of 12?

FOURTEEN, 14

If we have ten things and add four things to them, the name of the number of all these things together is **fourteen.**

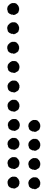




$$\begin{array}{r} 10 \\ 4 \\ \hline 14 \end{array}$$

$10 + 4 = 14$. Ten and four are fourteen.

We write fourteen with the figures 1 and 4, 14. We put the 1 in tens' place by setting the 3 in units' place. 14 means 1 ten and 4 units, like this group of dots:



$13 + 1 = 14$ $12 + 2 = 14$

A dozen and two are fourteen.

Of what does the syllable "teen" in fourteen remind us?

Show by splints that each of these number-facts is true:

$11 + 3 = 14$, $9 + 5 = 14$, $8 + 6 = 14$, $7 + 7 = 14$, $14 - 2 = 12$.

NUMBER-STORIES

1. Tom was fourteen years old. His brother was six years old. How many years older was Tom?

2. Mary was seven years old, and Susan was seven, too. How many years had both lived?

3. Willie and his little brother had together fourteen cents. Willie took eight cents for himself and gave George the rest. How many did George have?

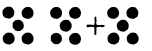
4. Tell number-stories about these number-facts: $14 - 8$, $7 + 7$, $14 - 4$, $9 + 5$, $12 + 2$, $13 - 1$.

5. $14 \div 7 = 2$ $14 \div 2 = ?$ $7 \times 2 = 14$ $2 \times 7 = ?$

Show each of these facts by splints and counters.

FIFTEEN, 15

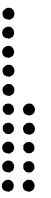
When we have ten things and add five to them, the name of the number of all of these together is **fifteen**.



We write fifteen with the figures 1 and 5, 15. We put the 1 in the tens' place by setting the 5 in the units' place.

$$\begin{array}{r} 10 \\ 5 \\ \hline 15 \end{array}$$

$10 + 5 = 15$. Ten and five are fifteen.



$13 + 2 = 15$ $\quad 9 + 6 = 15$ $\quad 12 + 3 = 15$

Show by splints that each of these number-facts is true: $14 + 1 = 15$, $\quad 11 + 4 = 15$, $\quad 8 + 7 = 15$, $\quad 15 - 5 = 10$, $15 - 7 = 8$, $\quad 15 - 9 = 6$.

MONEY

5 cents = 1 nickel.
10 cents = 1 dime.
2 nickels = 1 dime.

1 dime and 1 nickel make 15 cents. 3 nickels = 15 cents.

1. Three boys had three nickels. How many cents could they get for these nickels all together?

2. Willie had 6 cents, Johnny 5, and Charlie enough more to make 15 cents. How many did Charlie have?

3. Mary's father gave her fifteen cents. She spent one nickel for a little china doll, and four cents for a picture card to put in her doll-house. How many cents were left?

4. Louise had a dime, and Sarah a nickel. They spent six cents for car fares, and five cents for cookies. How many cents did they have then?

REVIEW

1. Add: 11 10 2 9 7 2. Subtract: 14 14 14 14 14
3 4 12 5 7 5 1 6 2 11

3. $15 \div 3 = 5$ $5 \times 3 = 15$ Answer $15 \div 5 =$ $3 \times 5 =$

4. Show each of these facts by splints and counters.

5. Add: 11 12 7 9 14 6. Subtract: 15 15 15 15 15
4 3 8 6 1 3 4 9 10 12

7. Subtract: 8 12 10 9 8 6 5 10 13
5 6 3 2 4 2 3 4 6

8. Subtract: 7 13 10 9 8 3 10 7 12
2 2 6 4 3 1 5 4 5

9. Find $13 \div 2$, $11 \div 2$, $9 \div 2$, $7 \div 2$, $5 \div 2$, $3 \div 2$. Are these odd or even numbers?

10. Willie always had as a present from his father one cent for each year he was old on his birthdays, and one more cent to help him grow. One year his father gave him fourteen cents. How old was he that birthday?

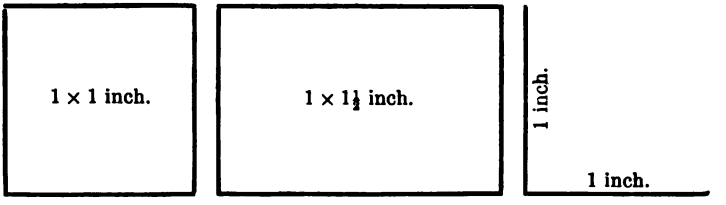
11. Mary found ten eggs when she went to the barn. She broke one, bringing them to the house. But her mother gave her as many more as she needed to make thirteen in all. How many did her mother give her?

12. Write the Multiplication Table of Twos on the blackboard without any copy.

13. Divide each even number from 2 to 24 by 2. Make a division table, beginning it like this:

$2 \div 2 = 1$	$6 \div 2 = 3$	$10 \div 2 =$			
$4 \div 2 = 2$	$8 \div 2 = 4$	$12 \div$			

FORMS AND FRACTIONS

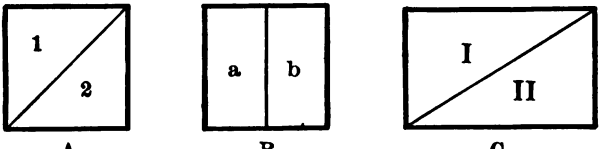


Rectangle. Square. | Rectangle. Oblong. | Right Angle.

A *rectangle* is a form in which each angle is a right angle. A rectangle always has four sides.

A *square* is a rectangle all of whose sides are equal.

An *oblong* is any rectangle that is not a square. The opposite sides of oblongs are always equal.



A B C

1. What is the name of the form *A*? *B*? *C*?
2. What is the name of the form 1? a? I?
3. Point out ½ of *A*. ½ of *B*. ½ of *C*.
4. Point out right angles in *A*, *B*, and *C*.
5. Make an oblong with sides one and two inches long. Divide it into two squares.
6. Make another, and divide it into two triangles.

Each square in 5 and each triangle in 6 is ½ of the oblong.

THREES

3 6 9 12 15 18 21 24 27 30 33 36

0 + 3 = 3	3 + 3 = 6	6 + 3 = 9
9 + 3 = 12	12 + 3 = 15	15 + 3 = 18
18 + 3 = 21	21 + 3 = 24	24 + 3 = 27
27 + 3 = 30	30 + 3 = 33	33 + 3 = 36

Show by splints that each of these facts is true.

3 × 1 = 3	3 × 7 = 21
3 × 2 = 6	3 × 8 = 24
3 × 3 = 9	3 × 9 = 27
3 × 4 = 12	3 × 10 = 30
3 × 5 = 15	3 × 11 = 33
3 × 6 = 18	3 × 12 = 36

MULTIPLICATION TABLE OF THREES

We read this, 3 1's are 3, or three times one are three.

$4 + 4 + 4 = 12$ Three 4's = four 3's $3 + 3 + 3 + 3 = 12$

Are three 10's 30? $10 + 10 + 10 = 30$ Three 10's = ten 3's

$3+3+3+3+3+3+3+3+3+3=30$

1. Copy the Table of Threes on paper.

2. Count by 3's to 36. Write this counting in words, beginning, three, six, nine, and so on.

3. Write the Table on the blackboard without any copy.

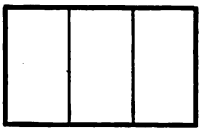
4. Make a division table of threes, beginning it like this:

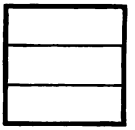
3 ÷ 3 = 1	9 ÷ 3 = 3				
6 ÷ 3 = 2	12 ÷				

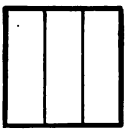
THIRDS

When anything is divided into three parts, each part is called a third. Three thirds equal one whole.


Circle


Rectangle


Square


Square

Into how many parts is the circle divided? the rectangle? each square?

Draw a line three inches long. Divide it into thirds.

One third is written in figures $\frac{1}{3}$.

Two thirds are written in figures $\frac{2}{3}$.

$\frac{3}{3}=1$. Why is this true? Look and see.

1. Eddie bought a cake and ate $\frac{1}{3}$ of it. How much of the cake was left?

2. How many thirds are there in an orange?

3. How many thirds in two oranges? In one orange are three thirds. 2 times $\frac{3}{3}$ are six thirds, $\frac{6}{3}$.

4. $\frac{1}{3}$ of 6 figs = how many figs? There are six times as many thirds in the 6 figs as there are in the one fig. $6 \times \frac{1}{3} = \frac{6}{3}$. $\frac{6}{3} = 2$.

5. What is $\frac{1}{3}$ of 6? $\frac{1}{3}$ of 9? $\frac{1}{3}$ of 12?

6. Which piece is the larger, $\frac{1}{3}$ of a pie or $\frac{1}{2}$ of a pie?

7. How much more does the whole of a cake cost than $\frac{1}{3}$ of it?

8. I started to walk to the depot. After I had walked $\frac{1}{3}$ of the distance, what part of it had I still to walk?

9. If your mother gave you some money and you spent $\frac{2}{3}$ of it, what part of the money would you have left?

TELLING QUANTITIES

We buy and sell butter and cheese by pounds, but we measure potatoes and vinegar by quarts. Do you know how much a quart of anything is? A quart measure for dry things like flour is larger than that for liquids like milk. Six quarts of flour would take just a little more space than seven quarts of milk. A pint of flour, too, takes a little more space than a pint of milk.

2 pints make 1 quart. 2 pts. = 1 qt.

1 pint makes $\frac{1}{2}$ quart. 1 pt. = $\frac{1}{2}$ qt.

1. Mrs. Brown had three quarts of milk, and six hungry children. She gave each $\frac{1}{2}$ pt. in a glass. How many quarts were left?

2. Willie bought a quart of peanuts, and gave one pint to his little brothers. What fraction of the quart did he keep himself?

4 quarts make 1 gallon. 4 qts. = 1 gal.

3. How many quarts are there in three gallons of oil?

4. Susie's mother had one gallon of maple syrup. One morning the family had three pints of maple syrup on the table for buckwheat cakes. How many pints were left in the gallon jug?

8 quarts make 1 peck.

4 pecks make 1 bushel.

8 qts. = 1 pk. 4 pks. = 1 bu. 32 qts. = 1 bu. 64 pts. = 1 bu.

4 qts. = $\frac{1}{2}$ pk. 2 pks. = $\frac{1}{2}$ bu. 16 qts. = $\frac{1}{2}$ bu. 16 pts. = 1 pk.

QUANTITIES

1. Willie bought 2 bushels of corn for his chickens, and fed them for 30 days 2 quarts each day. How many quarts were then left?

2. George bought 8 pecks of oats for his pony, and the grain dealer sent them in a 2-bushel bag, full. Was this correct?

3. A grocer had a barrel of apples. He sold $\frac{2}{3}$ of them. What part of the barrel of apples did he have left?

4. One boy had two thirds of an apple, another boy had one third, and still another had one half of an apple. Tell how many parts of apples they had altogether.

5. Two quarts of walnuts will fill how many cups, if each cup holds half a pint?

6. Fill a gallon measure with water, using a pint measure. How many times do you empty the pint measure?

7. How many quarts are there in 2 pecks? Which has more quarts, a peck or a gallon? Are the quarts the same in size?

8. A peck measure is one half full of oats. How many more quarts will it hold?

9. Henry filled a peck measure one quarter full of sand. How many quarts did he put into the measure? How many more quarts would it have held?

10. How many times must you empty a quart measure full of strawberries in order to fill a peck measure?

11. What part of a bushel of wheat is a peck of wheat?

12. What is the ratio of 1 to 4? If a bushel of oats costs a dollar, what will a peck of oats cost?

13. How many pints are there in 2 quarts? How many pecks are there in 16 quarts?

QUESTIONS

1. How many gallons are there in 8 quarts?

2. How many pints are there in 3 quarts? 5 quarts?

3. How many pints are there in a gallon and a quart?

4. How many quarts are there in a gallon and a quart? in a gallon and a pint?

5. If a pint of milk costs 4 cents, what will a quart cost? If a pint costs 3 cents, what will a gallon cost?

6. If milk is 3 cents a pint, what will a quart and a pint cost? At 3 cents a pint, what will two quarts cost?

7. At 2 cents a pint, how many cents will half a gallon of skimmed milk cost?

8. Fred drinks a pint of milk every day. In how many days does he drink a gallon? At 3 cents a pint, how much will his milk cost for one week?

9. If vinegar is 8¢ a quart, how much will $\frac{1}{2}$ pt. cost?

10. My lamp burns a pint of kerosene every night. How many nights will a gallon last me?

11. A milkman has a gallon of cream. How many pint bottles can he fill from it?

12. Should 7 quarts of milk cost more than 2 gallons, or less? Why?

13. A gallon jar is half full of water. I am going to fill it from a pint measure. How many times must I empty the measure?

14. A grocer had 10 quarts of syrup. He sold a gallon. How much syrup had he left?

15. Two gallons of oil will fill how many quart measures?

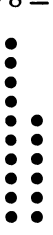
16. If you were paid 2 cents a pint for picking berries, how much money would you get for picking 3 quarts?

SIXTEEN, 16

We name ten and six things by the number **sixteen.**

$15+1=16$ $12+4=16$ $10+6=16$ $8+8=16$

We write sixteen with the figures 1 and 6, 16. We put the 1 in tens' place by setting the 6 in units' place.

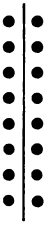


Show by splints that each of these number-facts is true: $10+6=16$, $8+8=16$, $4+12=16$, $9+7=16$, $11+5=16$.

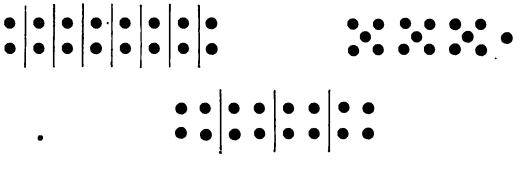
$4+4+4+4=16$. How many 4's are there in 16?

$2+2+2+2+2+2+2+2=16$. How many 2's are there in 16? $8+8=16$. How many 8's do we find in 16?

$4\times4=16$ $8\times2=16$ $2\times8=16$ $16\div4=4$ $16\div2=8$



Count these dots:



1. If eight girls in your school were sent this afternoon to the grocery by their mothers, each with two pennies to buy a yeast cake, how many cents would all have together?

2. Four boys spent sixteen cents for fishhooks: each spent as much as the others. How many cents did each spend?

3. Mary had a nickel, Kate a dime, and Annie a cent. How many cents did they have altogether?

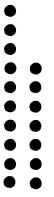
SEVENTEEN, 17

We name ten and seven things by the number **seventeen.**

Seven and ten make seventeen. $10+7=17$

$16+1=17$ $15+2=17$ $9+8=17$ $13+4=17$

Show each of these facts by splints and counters.



1. We cannot divide 17 by any smaller number exactly, without remainder.
2. We can divide 16 by 2, by 4, and by 8.
3. We can divide 15 by 3 and by 5.
4. We can divide 14 by 7 and by 2.
5. We cannot divide 13 without remainder.
6. We can divide 12 by 6, by 2, by 3, and by 4.
7. We cannot divide 11 without remainder.
8. We can divide 10 by 5 and by 2.
9. We can divide 9 by 3.
10. We can divide 8 by 4 and by 2.
11. We cannot divide 7 without remainder.
12. We can divide 6 by 2 and by 3.
13. We cannot divide 5 without remainder.
14. We can divide 4 by 2.

There are no multiplication or division facts to learn about 1 or 2 or 3 or 5 or 7 or 11 or 13 or 17 or 19.

About these numbers we learn only addition and subtraction facts.

15. Tell number-stories about 17, using cents, marbles, eggs, fish, dolls, apples, or whatever interests you, to show these facts: $10+7=17$ $15+2=17$ $17-11=6$ $17-8=9$ $17-3=14$ $17-5=12$

16. Add:

5	6	4	7	3	8	2	1
12	11	13	10	14	9	15	16

EIGHTEEN, 18

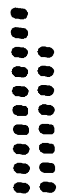
We name ten and eight things by the number eighteen.

Eight and ten make eighteen. [illegible]

[illegible]

[illegible]

[illegible]

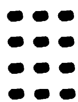
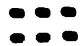


Show each of these facts [illegible]

[illegible] are three [illegible] [illegible] are ten and [illegible]

[illegible] are three [illegible] [illegible] are [illegible] and [illegible]

There are two [illegible] in [illegible] [illegible] [illegible]

This group of [illegible]  [illegible] times the group  [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Show these [illegible] picture.

[illegible]

1. [illegible] and a half [illegible] [illegible]

2. [illegible] measured [illegible]

3. [illegible] dozen and a [illegible] a dozen. [illegible]

REVIEWS OF NUMBERS AND FORMS

1. Tell number-stories about these facts:

$16 \div 2 = 8$ $16 - 6 = 10$ $16 \div 4 = 4$

$9 + 7 = 16$ $12 + 4 = 16$ $13 + 3 = 16$

2. Add:

2	5	8	1
14	11	8	15

3. Subtract:

16	16	16	16
6	9	12	15

4. Subtract:

17	17	17	17	17	17	17
4	3	9	6	2	10	1

5. Do what the sign tells:

17	14	16	12	17	17
−7	+3	+1	+5	−2	−9

6. Add:

15	10	9	12
3	8	9	6

7. Subtract:

18	18	18	18
2	4	5	11

8. Divide 18 by 2, by 3, by 6, and by 9.

9. Make stories about:

16−3	18−9	17−10	11+2	13+5	18−10
15+2	18−15	17−14	10+7	15−5	15+3
18−6	17−2	15−4	17−4	16−14	15−11

10. Draw an oblong 2×3 inches. Divide it into halves in several different ways.

11. Draw another oblong of the same size. Divide it into thirds.

12. Draw a triangle with one side of the right angle 2 inches long and the other side 1 inch long.

13. Draw a circle 1 inch in diameter and divide it into halves. A diameter is any straight line through the center of a circle.

NINETEEN, 19

We name ten and nine things by the number **nineteen.**

Nine and ten make nineteen. $10+9=19$

$15+4=19$ $16+3=19$ $12+7=19$ $14+5=19$

$18+1=19$ $5+5+5+4=19$ $4+4+4+4+3=19$

Show each of these facts by splints and counters.

NUMBER-STORIES

1. There were 19 boys in the school yard. 6 of them went home. How many were left?

2. 19 boys came to school early in the morning to play marbles. When they reached the school yard 2 of them found that they had lost their marbles on the way to school. How many had their marbles with them?

3. Nineteen girls were trying to cut paper dolls out of white paper. Fourteen of them made very nice dolls. How many of them were not able to make the dolls?

4. Three times six boys went swimming. One more boy asked his mother if he could go, but she said, "No!" How many boys wanted to go?

5. Eight times two girls walked home from school together in pairs. Three girls walked side by side. How many girls were there in all?

6. Add:

12	11	14
7	8	5

7. $3+5+6+5=$ **8.** $10+6+3=$

9. $8+4+3+4=$ **10.** $12+5+2=$

11. Subtract:

19	19	19	19	19	19	19	19	19
2	4	5	12	13	1	16	8	9

12. Tell number-stories about the facts in **7**, **8**, **9**, **10**, and **11**.

PARTITIONS

3 $3=2+1$

5 $5=3+2$ $5=2+2+1$ $5=4+1$

7 $7=5+2$ $7=6+1$ $7=4+3$ $7=3+3+1$

11 $11=7+4$ $11=8+3$ $11=9+2$ $11=6+5$
$11=5+5+1$ $11=3+3+3+1+1$ $11=4+4+3$

13 $13=11+2$ $13=8+5$ $13=9+4$ $13=7+6$
$13=5+5+3$ $13=4+4+4+1$ $13=3+3+3+3+1$
$13=2+2+2+2+2+2+1$ $13=10+3$

17 $17=13+4$ $17=5+5+5+2$ $17=10+7$ $17=15+2$
$17=8+8+1$ $17=4+4+4+4+1$ $17=12+5$
$17=3+3+3+3+3+2$ $17=16+1$ $17=7+7+3$

19 $19=17+2$ $19=5+5+5+4$ $19=16+3$ $19=14+5$
$19=4+4+4+4+3$ $19=3+3+3+3+3+3+1$
$19=9+9+1$ $19=13+6$ $19=11+8$ $19=10+9$

1. Divide 3, 5, 7, 11, 13, 17, and 19 by 2, and show how many ones are left over.

$2\overline{)3}\ 1$, because $2 \times 1 = 2$ and $2 + 1 = 3$

$2\overline{)17}\ 1$, because $2 \times 8 = 16$ and $16 + 1 = 17$

2. Divide 5, 7, 11, 13, 17, and 19 by 3.

$3\overline{)13}\ 1$, because $3 \times 4 = 12$ and $12 + 1 = 13$

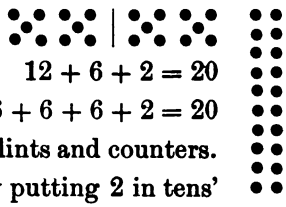
3. Divide 7, 11, 13, 17, and 19 by 5.

$5\overline{)19}\ 4$, because $5 \times 3 = 15$ and $15 + 4 = 19$

4. Divide 13, 17, and 19 by 7.

$7\overline{)13}\ 6$, because $7 \times 1 = 7$ and $7 + 6 = 13$

TWENTY, 20

We call two tens **twenty**. 

$10 + 10 = 20$ $15 + 5 = 20$ $12 + 6 + 2 = 20$

$5 + 5 + 5 + 5 = 20$ $6 + 6 + 6 + 2 = 20$

Show each of these facts by splints and counters.

We write twenty in figures by putting 2 in tens' place, and to show that 2 is in tens' place, we set the zero, 0, in units' place. Write 20.

$2 \times 10 = 20$ $4 \times 5 = 20$ $3\overline{)20} + 2$

There are six 3's or three 6's in 20 and 2 units over.

We write this: $(3 \times 6) + 2 = 20$ or $(6 \times 3) + 2 = 20$.

We place the marks of parenthesis ( ) around the 6 and 3 to show that 3 multiplies 6, not $6 + 2$. If we wrote $3 \times 6 + 2$, this would mean 3 times 8, for $6 + 2 = 8$.

1. Find how many times 20 contains 3, 7, 9, with how many units over.

2. Draw on the blackboard a square containing 20 square inches.

3. Add:

1	3	18	15	13	6	4	12	11	10
19	17	2	5	7	14	16	8	9	10

4. Subtract:

20	20	20	20	20	20	20	20	20	20
18	15	10	12	1	3	4	6	7	9

5. How would you divide twenty apples among five boys? among six boys?

6. Can we divide twenty oranges among seven girls so that each may have as many as any other? How many would have only two?

FACTS OF NUMBER, 11 TO 20

All Additions:

10+ 1=11	11+2=13	12+4=16	13+7=20	15+5=20
10+ 2=12	11+3=14	12+5=17	14+1=15	16+1=17
10+ 3=13	11+4=15	12+6=18	14+2=16	16+2=18
10+ 4=14	11+5=16	12+7=19	14+3=17	16+3=19
10+ 5=15	11+6=17	12+8=20	14+4=18	16+4=20
10+ 6=16	11+7=18	13+1=14	14+5=19	17+1=18
10+ 7=17	11+8=19	13+2=15	14+6=20	17+2=19
10+ 8=18	11+9=20	13+3=16	15+1=16	17+3=20
10+ 9=19	12+1=13	13+4=17	15+2=17	18+1=19
10+10=20	12+2=14	13+5=18	15+3=18	18+2=20
11+ 1=12	12+3=15	13+6=19	15+4=19	19+1=20

All Multiplications:

2×6=12	2×8=16	2×10=20	3×5=15	4×4=16
2×7=14	2×9=18	3× 4=12	3×6=18	4×5=20

Copy and answer:

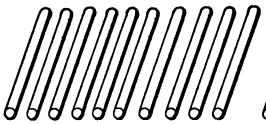
1. $10 \div 5 =$	9. $4 \times 4 =$	17. $\frac{1}{6}$ of 12 =
2. $9 \div 3 =$	10. $18 \div 2 =$	18. $\frac{1}{7}$ of 14 =
3. $8 \div 4 =$	11. $20 \div 5 =$	19. $\frac{2}{3}$ of 9 =
4. $12 \div 6 =$	12. $20 \div 10 =$	20. $\frac{2}{5}$ of 10 =
5. $15 \div 5 =$	13. $\frac{1}{2}$ of 16 =	21. $\frac{3}{4}$ of 12 =
6. $16 \div 8 =$	14. $\frac{1}{3}$ of 18 =	22. $\frac{3}{5}$ of 15 =
7. $18 \div 6 =$	15. $\frac{1}{4}$ of 20 =	23. $18 - 5 + 6 =$
8. $7 \times 2 =$	16. $\frac{1}{5}$ of 15 =	24. $14 + 3 - 10 =$

25. Subtract from 20 every number from 10 to 19.

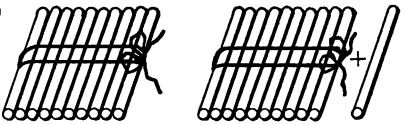
20 20
10 11 and so on.

26. $4\overline{)16}$ $2\overline{)18}$ $4\overline{)20}$ $5\overline{)15}$ $5\overline{)20}$ $6\overline{)18}$ $3\overline{)12}$

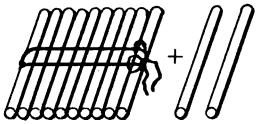
REVIEW OF NUMBERS 1 TO 20



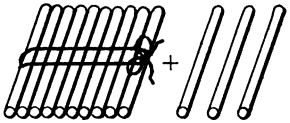
Ten 1's are 10



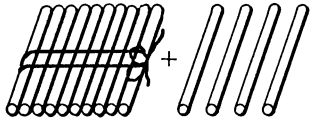
10 + 1 = 11



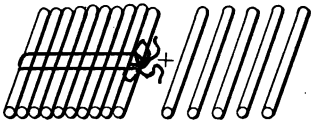
10 + 2 = 12



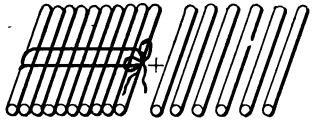
10 + 3 = 13



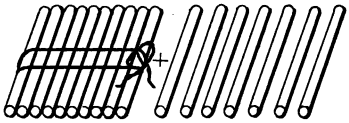
10 + 4 = 14



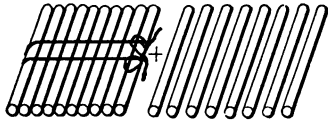
10 + 5 = 15



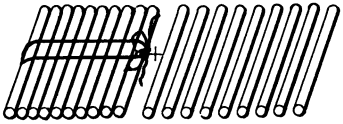
10 + 6 = 16



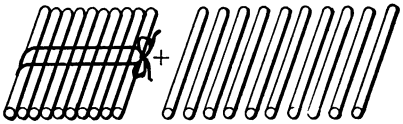
10 + 7 = 17



10 + 8 = 18



10 + 9 = 19

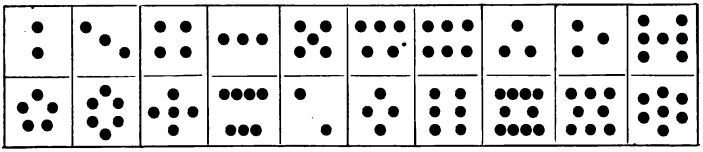


10 + 10 = 20

1–20

The teacher may make sight number cards, using ordinary paper or, better, drawing paper, 4 × 5 in. or 4 × 6 in. size. The figures should be as large as those on page 10 for blackboard writing. They may be drawn with brush and diluted ink, or with blue pencil. The children may make sets for themselves, either as large as the teacher's set, or much smaller, 2 × 3 in., with figures as large as those on page 11. These sets of sight cards should review all the number facts as high as 20, and drill the pupil in quick recognition of number groups as high as 7 or even 10. The teacher with a set of cards in her hand may call for answers in various ways. The answers are to be remembered instantly and with certainty.

For a set of sight-counting cards :



Cards involving 10 may be written like these :

10+1=	10+2=	10+3=	10+4=	10+5=	10+6=	10+7=	10+8=	10+9=	10+10=
10×2=	$\frac{10}{2}$=	2)10	5)10	10÷2=	10−1=	10−2=	10−3=	10−4=	10− 5=
10−6=	10−7=	10−8=	10−9=	10)10	5+5=	5×2=	2×5=	9+1=	8+ 2=
7+3=	6+4=	18−8=	19−9=	17−7=	16−6=	15−5=	14−4=	13−3=	12− 2=

The variety of possible ways to use the numbers to 20 in combinations producing not more than 20 and using no partition facts or fractions over $\frac{1}{2}$ is too great to permit of complete illustration. Not all the combinations or forms of signs to indicate operations involving 10 are indicated even in these forty spaces.

DAYS OF THE WEEK

There are seven days in one week. After seven days we begin the names of the days over again. The names of the days are: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday.

Each day is one seventh of a week. 7 days = 1 week.

At midnight we change the name of the day.

Many, many years ago, when our forefathers lived on the other side of the great Atlantic Ocean, most of them thought that the earth was ruled by beings who live in the sky. So they named each day for some one of these beings. We use their names for the days.

Sunday is named for the Sun in the sky.
Monday is named for the Moon in the sky.
Tuesday is named for Tyr, who leads in battle.
Wednesday is named for Woden, the wise father of all.
Thursday is named for Thor, the thunder.
Friday is named for Freya, the loving wife and mother.
Saturday is named for Saturn, who began the world with time.

ABBREVIATIONS

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.

Yesterday was the day before this day.
To-day is this day we are now living in.
To-morrow will be the day after this day.
Day before yesterday was two days ago.
Day after to-morrow will be two days after this.
A fortnight is two weeks, or fourteen nights or days.

1. What day will be ten days from to-day? What day was ten days ago?

2. Name the days when we go to school.

QUESTIONS

1. A man has a dozen letters to be mailed and only four stamps. How many stamps must he buy?

2. How many cents are 10¢ and 2¢? 10¢ and 4¢? 16¢ and 1¢? 3¢ and 10¢? 14¢ and 5¢? 13¢ and 3¢? 12¢ and 8¢? 13¢ less 5¢? 19¢ less 7¢?

3. Make 12 dots in a row. Make 2 more dots under them. How many dots in all have you made? Add 5 more. How many have you made now?

4. Nine boys have twenty marbles. Four of them have ten marbles altogether. Each of the rest has as many as any of the others. How many marbles has each of these?

5. Count by 2's from 1 to 19 and from 19 back to 1.

6. Count by 3's from 19 backwards to 1.

7. Count by 3's from 1 to 19.

8. Count by 4's from 0 to 20 and from 20 back to 0.

9. Count by 4's from 17 back to 1.

10. Count by 2's from 3 to 19 and from 19 back to 3.

11. Count by 3's from 2 to 20 and from 20 back to 2.

12. Count by 4's from 5 to 17.

13. Count backwards by 5's from 20 to 0.

14. Count backwards by 5's from 19 to 4.

15. Count by 6's from 0 to 18 and back from 18 to 0.

16. Count by 7's to 20, beginning at 3. What is the highest number we reach?

17. Count by 5's to 20, beginning at 4. What is the highest number we reach?

18. Count by 4's to 20, beginning at 2. What is the highest number we reach?

REVIEW

1. Lay 1 bundle of 10 splints. Count out ten loose ones and tie them into a bundle. How many splints are there in the two bundles? Write the number 20. What does the zero mean? Have you any loose splints when you show 20 in bundles of ten splints?

2. How many figures do you write for eleven? for twelve? for thirteen? for twenty?

3. In all these numbers, what does the figure on the left show? What does the figure on the right show?

4. While Mary was feeding 7 birds 4 more birds came. Then how many birds were there?

5. There are 9 cups in 1 row, and 4 cups in another row. How many cups are there in both rows?

6. 10 pencils and 2 pencils are how many pencils?

7. Jennie had a dime and 2¢. She spent $\frac{1}{2}$ of her money. How many cents did she have left?

8. How many marbles must you put with 9 marbles in order to have 14 marbles?

9. I have four dollars. How many more dollars must I get in order to have fifteen dollars?

10. Edwin had 13 marbles. He lost 5. How many had he left?

11. Make 2 triangles. Under them make 2 squares. How many sides are there in the triangles? How many sides in the square? How many sides altogether in all the squares and triangles?

12. An orchard has 10 apple trees and 4 pear trees. How many trees are there in the orchard?

13. Henry has ten cents. How many more cents must he get in order to have 14¢?

QUESTIONS

1. Write the numbers made up of:

One 10 and 7 units. One 10 and 3 units. One 10 and 6 units. One 10 and 5 units. One 10 and 8 units. One 10 and 2 units. One 10 and 1 unit. One 10 and 4 units. One 10 and 9 units. One 10. Two 10's.

Seven units. Three units. Eight units. Six units. Five units. Nine units.

2. A farmer had 19 animals in a field. 8 of them were sheep and the rest were cows. How many cows were there in the field?

3. Ella has 11¢ and Maud has 17¢. How many more cents has Maud than Ella?

4. Alice had 19 splints in her hand. She put 7 of them on her desk. How many splints did she keep in her hand?

5. I had 20¢ and lost 6¢. How many cents had I left?

6. Mrs. Smith paid $16 for a jacket and $4 for a hat. How many dollars did she spend?

7. A farmer had 19 chickens. He sold 5 of them. How many were left?

8. There were 20 barrels of flour in a store. 6 of them were sold. How many were left?

9. One ladder has 19 rungs. Another ladder has 14 rungs. What number tells the difference in rungs between the ladders?

10. I paid 3¢ for a pencil and 16¢ for paper. How many cents did I spend?

11. Emma had 20¢. She paid 2 nickels in car fares. How much money had she left?

12. 12 lemon pies and 7 peach pies are how many pies?

SUBTRACTING

1. John had 10 cents, and spent 7 cents for a whistle. He had three cents left.

2. Mary had 16 paper dolls, and gave away 11. She kept 5 for herself.

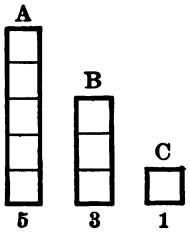
Give each boy and girl one combination to tell or write a story about.

3 – 2	5 – 3	5 – 1	3 – 1	12 – 6
4 – 3	9 – 4	6 – 2	9 – 6	7 – 6
3 – 1	2 – 2	9 – 5	12 – 8	13 – 9
8 – 5	7 – 4	6 – 6	9 – 8	5 – 5
8 – 4	15 – 9	16 – 7	11 – 5	4 – 2
12 – 9	11 – 8	7 – 7	4 – 1	6 – 3
10 – 3	3 – 3	1 – 1	8 – 7	9 – 4
9 – 8	13 – 8	17 – 9	9 – 9	20 – 6
11 – 4	8 – 3	10 – 1	20 – 1	14 – 5
4 – 4	15 – 6	9 – 3	13 – 7	20 – 8
6 – 1	12 – 5	13 – 5	14 – 8	16 – 9
6 – 5	13 – 6	10 – 8	11 – 3	13 – 4
10 – 9	7 – 1	8 – 8	18 – 9	10 – 3
7 – 3	5 – 2	20 – 2	11 – 9	14 – 6
7 – 5	8 – 1	10 – 4	10 – 7	10 – 5
5 – 4	2 – 1	12 – 4	20 – 3	15 – 8
9 – 1	11 – 2	14 – 7	17 – 8	12 – 7
7 – 2	18 – 8	20 – 7	20 – 9	20 – 5
9 – 2	14 – 9	20 – 4	11 – 7	16 – 8
10 – 6	12 – 3	11 – 6	10 – 10	15 – 7

3. Write out the answers to the questions in each column: $3 - 2 = 1$, $5 - 3 = 2$.

4. Tell the answers, taking turns around the class.

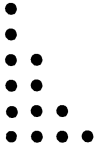
RATIOS



A is $5 \times C$. B is $3 \times C$.
C is $\frac{1}{5}$ of A. C is $\frac{1}{3}$ of B.

We say that the *ratio* of A to C is 5; and that the *ratio* of B to C is 3. Ratio means how large anything is compared with anything else. We say that $\frac{1}{5}$ is the ratio of C to A; and that $\frac{1}{3}$ is the ratio of C to B. This means that C is $\frac{1}{5}$ of A and $\frac{1}{3}$ of B.

What is the ratio of F to D? of E to D? of D to E? of D to F? of D to $E + F$?



The ratio of 6 to 1 is 6.
The ratio of 4 to 1 is 4.
The ratio of 2 to 1 is 2.

The ratio of 1 to 2 is $\frac{1}{2}$. Why?
The ratio of 1 to 4 is $\frac{1}{4}$. Why?
The ratio of 1 to 6 is $\frac{1}{6}$. Why?

In the forms A, B, and C, the ratio of B to A is $\frac{3}{5}$, because B is $\frac{3}{5}$ of A. The ratio of A to B is $\frac{5}{3}$, because A is three thirds of B and two thirds of B together.

The ratio of 4 to 6 things is $\frac{4}{6}$, because 1 is $\frac{1}{6}$ of 6 and there are 4×1 thing in 4 things. The ratio of 6 to 4 is $\frac{6}{4}$, because 1 is $\frac{1}{4}$ of 4 and there are 6×1 thing in 6 things.

1. What is the ratio of 1 to 7? of 7 to 1? of 2 to 7? of 7 to 2? of 3 to 7? of 7 to 3? of 3 to 10? of 10 to 3?

2. Find the ratio of 4 to 8, 16, 12, 2, 20.

QUESTIONS

1. I have 3 black chicks and 5 times as many white ones. How many white chicks have I?

2. How many figs are 3 times 4 figs? 5 times 3 figs?

3. 4 pictures cost $5 apiece. How many dollars did they all cost?

4. A roll of braid costs 16¢. What will be the price of one quarter of the roll?

5. Helen had 12¢. She gave $\frac{1}{4}$ of her money to her sister Alice. How many cents did she give to Alice?

6. If Charles can ride 20 miles in 1 hour on his wheel, how far can he ride in a quarter of an hour?

7. If you bought $\frac{1}{4}$ of a dozen of bananas, how many bananas would you have? how many if you bought $\frac{3}{4}$ of a dozen? how many if you bought $\frac{1}{2}$ of a dozen?

8. A man walks 4 miles an hour. How far does he walk in 4 hours? in 5 hours? in $4\frac{1}{2}$ hours?

9. Edgar had 6¢. Arthur has 3 times as much money as Edgar. How many cents has Arthur?

10. If we use 3 crayons a day in this room, how long will 18 crayons last us?

11. If a man worked only half the working days in a week, how many days would he be idle? How many days would he be at work?

12. If you walk 1 mile every school day, how many miles do you walk in a week? If the walk is 1 mile each way, how many miles do you walk in a week, when you stay at school for noon-recess?

13. During Christmas week I was at home only 2 days. How many days was I away from home?

RATIOS

1. Do you see 4 balls or spheres together? Is there 1 ball near them? Do you see the 3 balls hanging from the door? How many balls do you see in all?

2. Do you see five piles of cylinders and one single cylinder? Count the number of cylinders in each pile.

3. Do you see six piles of cubes? Count the number of cubes in each pile. Do you see one cube separate from the rest?

4. Point to 1 cube and 7 cubes. 1 cube $\times$ 7 = 7 cubes. 7 cubes $\div$ 1 = 7. The ratio or number relation of 7 cubes to 1 cube is 7. The ratio or number relation of 1 cube to 7 cubes is $\frac{1}{7}$, one seventh.

5. Point to 2 cubes and 6 cubes. 2 cubes $\times$ 3 = 6 cubes. 6 cubes $\div$ 2 = 3. The ratio of 6 cubes to 2 cubes is 3. The ratio of 2 cubes to 6 cubes is $\frac{1}{3}$, one third.

6. Point to 1 sphere and to 8 spheres. 1 sphere $\times$ 8 = 8 spheres. 8 spheres $\div$ 1 = 8. The ratio of 8 spheres to 1 sphere is 8. The ratio of 1 sphere to 8 spheres is $\frac{1}{8}$, one eighth.

7. Point to 4 cubes and 6 cubes. The ratio of 4 cubes to 6 cubes is $\frac{4}{6}$, four sixths. The ratio of 6 cubes to 4 cubes is $\frac{6}{4}$, six fourths.

8. Point to 2 cubes, to 4 cubes, to 3 cubes, and to 6 cubes.

9. How much higher is the pile of 4 cubes than the pile of 2 cubes?

10. How much higher is the pile of 6 cubes than the pile of 3 cubes?

11. How high is the pile of 2 cubes compared with the pile of 4 cubes?

12. How high is the pile of 3 cubes compared with the pile of 6 cubes?

FOURS

4 8 12 16 20 24 28 32 36 40 44 48

0 + 4 = 4	4 + 4 = 8	8 + 4 = 12
24 + 4 = 28	28 + 4 = 32	32 + 4 = 36
12 + 4 = 16	16 + 4 = 20	20 + 4 = 24
36 + 4 = 40	40 + 4 = 44	44 + 4 = 48

Show by splints that each of these facts is true.

4 × 1 = 4	4 × 7 = 28
4 × 2 = 8	4 × 8 = 32
4 × 3 = 12	4 × 9 = 36
4 × 4 = 16	4 × 10 = 40
4 × 5 = 20	4 × 11 = 44
4 × 6 = 24	4 × 12 = 48

MULTIPLICATION TABLE OF FOURS

We read this, 4 1's are 4, or four times one are four.

5+5+5+5=20 4 5's=5 4's 4+4+4+4+4=20

Are 4 8's 32? 8+8+8+8=32

4 8's = 8 4's 4+4+4+4+4+4+4+4=32

1. Copy the Table of Fours on paper. 2. Learn Fours.

3. Show that 4 1's=4, 4 4's=16, 4 7's=28, 4 2's=8, 4 6's=24, 4 9's=36, 4 3's=12, 4 10's=40, 4 11's=44.

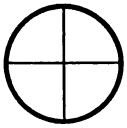
4. Write the Table on the blackboard without any copy.

5. Make a division table of fours, beginning it like this:

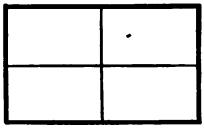
4÷4=1	12÷4=3	20÷			
8÷4=2	16÷4=4				

FOURTHS OR QUARTERS

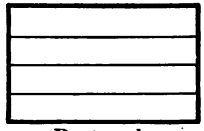
When anything is divided into four parts, each part is called a fourth or a quarter. Four fourths or four quarters make one whole. $4 \times \frac{1}{4} = 1$.



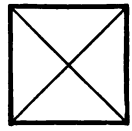
Circle



Rectangle



Rectangle



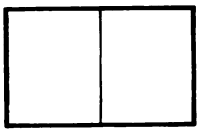
Square

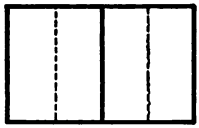
Into how many parts is the circle divided? Each rectangle?

Into how many parts is the square divided?

How many fourths are there in each of these forms?

$\frac{4}{4} = 1$. Four quarters are one. One half of four is 2. $4 \div 2 = 2$. One half of four fourths is two fourths. $\frac{1}{2}$ of $\frac{4}{4} = \frac{2}{4}$; $\frac{2}{2} = 1$; $\frac{3}{3} = 1$; $\frac{4}{4} = 1$; $\frac{1}{2} = \frac{2}{4}$. Read each of these facts in words.





1. Make three rectangles, each one inch high by two inches long. Cut one rectangle into halves. Cut the second rectangle into fourths. Place the halves upon the third rectangle, and the fourths upon the halves. Are the two halves equal to the four fourths? Are the two halves and the four fourths equal to the third rectangle?

2. Willie had a quarter of a dollar, his aunt gave him half a dollar. How many quarters of a dollar did he have then? How many fourths of a dollar?

3. A barrel of flour contains how many fourths of a barrel? If $\frac{2}{4}$ of the flour are taken out of the barrel, how much of the flour is left in the barrel?

TELLING WEIGHTS

Did you ever buy anything at a store? Did you ever notice how much heavier 5 pounds of sugar are than 2 pounds of coffee? Did you ever lift a piece of iron weighing just one pound?

We buy some things by their weight or heaviness.

One pound is the standard measure of weight, just as a foot is for length, an hour for time, and a quart for quantity or amount.

16 ounces (oz.) make 1 pound (lb.).

1 oz. $= \frac{1}{16}$ lb. 1 lb. $= 16$ oz. $\frac{1}{2}$ lb. $= 8$ oz.

1. Name five things sold by weight.

2. If a pound of meat costs 20¢, what will $\frac{1}{2}$ of a pound cost?

3. A melon weighs 20 ounces. How many more ounces than 1 pound does it weigh?

4. What is the ratio of 4 ounces to 16 ounces?

5. If a pound of candy costs 20¢, how much will a quarter of a pound cost? How much will $\frac{3}{4}$ of a pound cost?

6. If Mr. Brown and his family use 3 pounds of sugar in 4 days, how many ounces do they use in 1 day?

7. How many ounce weights are equal to a quarter of a pound weight?

8. If a quarter of a pound of coffee costs 9¢, how many cents will a pound cost?

9. At 16¢ a pound, what will half a pound of crackers cost?

10. When pepper is 6¢ an ounce, can you buy half a pound of pepper for half a dollar?

REVIEWS

1. Can you see that the 2 cubes in the picture on page 68 are $\frac{2}{3}$ of the 3 cubes, and that the 3 cubes are $\frac{3}{2}$ of the 2 cubes?

2. Make all the comparisons you can of these cylinders, cubes, and spheres. You are finding ratios.

3. Draw on paper forms, and write on paper dots, to show these ratios: 6, 3, 2, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$.

4. Make forms on the blackboard to show these ratios: 6, $\frac{1}{6}$, 2, $\frac{1}{2}$, 3, $\frac{1}{3}$.

5. Which is the last day of the week? The first day? The second day? The fourth day? The sixth day? The seventh day? The fifth day?

6. A man worked on Thursday, Friday, and Saturday. He was paid two dollars for every day he worked. How many dollars did he get?

7. Arthur and Fred ate $\frac{3}{4}$ of a cake. They gave the rest away. What part of the cake did they give away?

8. Hattie had $\frac{3}{4}$ of a dollar. She spent $\frac{1}{2}$ of a dollar for a doll. How much money had she left?

9. Fred gave $\frac{1}{4}$ of his orange to Willie, and another $\frac{1}{4}$ to Frank. He ate another $\frac{1}{4}$. How much of the orange did he have left?

10. John was sent to the grocery to buy 2 ounces of pepper, 1 pound of coffee, $\frac{1}{2}$ pound of tea, $\frac{1}{4}$ pound of cinnamon, and 3 pounds of sugar. How many pounds did he carry home to his mother?

11. Mary had 25 cents with which to buy 4 lbs. of sugar at 5¢ a pound, and $\frac{1}{4}$ lb. of chocolate cream candy at 20¢ a pound. Did she have enough money to buy these things?

NUMBERS TWENTY-ONE TO TWENTY-FIVE

21

Twenty things and one thing we call by the number *twenty-one.*

$10+10+1=21$ $\quad 20+1=21$ $\quad 16+5=21$

$15+6=21$ $\quad 10+11=21$ $\quad 12+9=21$ $\quad 18+3=21$

We write the two in tens' place and the 1 in units' place.

22

Twenty and two we call *twenty-two.*

$10+10+2=22$ $\quad 20+2=22$ $\quad 16+6=22$

$15+7=22$ $\quad 10+12=22$ $\quad 18+4=22$

$14+8=22$ $\quad 2\times11=22$ $\quad 22\div11=2$

23

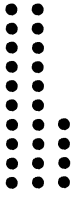
Twenty and three we call *twenty-three.*

$10+10+3=23$ $\quad 20+3=23$ $\quad 16+7=23$

$15+8=23$ $\quad 10+13=23$ $\quad 18+5=23$

$14+9=23$ $\quad 23=(4\times5)+3$ $\quad 23=(6\times3)+5$

24



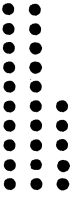
Twenty and four we call *twenty-four.*

$10+10+4=24$ $\quad 20+4=24$ $\quad 16+8=24$

$15+9=24$ $\quad 10+14=24$ $\quad 18+6=24$

$14+10=24$ $\quad 6\times4=24$ $\quad 12\times2=24$

25



Twenty and five we call *twenty-five.*

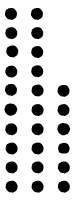
 5 5's are 25.

$10+10+5=25$ $\quad 5\times5=25$ $\quad 25\div5=5$ $\quad 24+1=25$

$(6\times4)+1=25$ $\quad (3\times7)+4=25$ $\quad (8\times3)+1=25$

NUMBERS TWENTY-SIX TO TWENTY-NINE

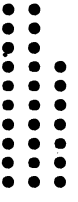
26



Twenty things and six things we call by the number *twenty-six.*

$10+10+6=26$	$20+6=26$	$16+10=26$
$15+11=26$	$12+14=26$	$18+8=26$
$19+7=26$	$26=(5\times5)+1$	$26=(8\times3)+2$

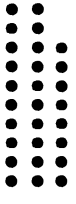
27



Twenty and seven we call *twenty-seven.*

$10+10+7=27$	$20+7=27$	$16+11=27$
$15+12=27$	$10+17=27$	$18+9=27$
$14+13=27$	$9\times3=27$	$(6\times4)+3=27$

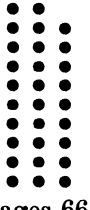
28



Twenty and eight we call *twenty-eight.*

$10+10+8=28$	$20+8=28$	$16+12=28$
$15+13=28$	$14+14=28$	$18+10=28$
$19+9=28$	$7\times4=28$	$(5\times5)+3=28$

29



Twenty and nine we call *twenty-nine.*

$10+10+9=29$	$20+9=29$	$16+13=29$
$15+14=29$	$18+11=29$	$19+10=29$
$(7\times4)+1=29$	$(2\times10)+9=29$	$(8\times3)+5=29$

1. Tell number-stories about all the facts on pages 66 and 67.

2. Copy on the blackboard the facts on pages 66 and 67.

3. Show all the facts on pages 66 and 67 with splints, pennies, and counters.

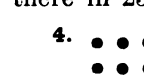
21 TO 29

Twenty-one 21	Twenty-two 22	Twenty-three 23
Twenty-four 24	Twenty-five 25	Twenty-six 26
Twenty-seven 27	Twenty-eight 28	Twenty-nine 29

1. How many 10's are there in 21? What is left over?

2. How many 10's are there in 24? What are left over?

3. How many 10's and how many units, or ones, are there in 23? in 22? in 27? in 26? in 25? in 28? in 29?

4.  How many rows of 7 dots are there? of 3 dots? How many dots are there in all?

5. $3 \times 7 = ?$ $7+7+7=?$ $3+3+3+3+3+3+3=?$ How many 7's in 21? What is $\frac{1}{7}$ of 21? What is $\frac{1}{3}$ of 21? How many 3's in 21? $7 \times 3 = ?$ $7\overline{)21}$ $3\overline{)21}$

$ is the sign for a dollar of money.

6. A dealer sold 7 hats at $3 each? How many dollars did he get?

7. There were 21 apples in a barrel. I took out $\frac{1}{3}$ of them. How many apples did I take out?

8. Ethel gave 2 dimes and a cent for 3 yards of braid. What was the price of the braid a yard?

9. $17 + 7 = ?$ If we wish to do so, we can find the answer by these steps:

$17 + 3 = 20$ $\quad 7 - 3 = 4$ $\quad 20 + 4 = 24$

10. $18 + 6 = ?$ $\quad 18 + 2 = 20$ $\quad 6 - 2 = 4$ $\quad 20 + 4 = 24$

11. Add:

8	7	6	2	8	7	9	5	4
6	3	2	7	3	2	2	5	3
4	5	2	14	3	2	6	4	5
2	4	11	1	5	1	3	8	10
5	4	3	1	3	9	4	1	3

QUESTIONS

One quarter of a dollar = 25¢

1. Etta bought 8 lead pencils at 3¢ apiece. She gave the clerk a quarter. What change should she get?

2. Mrs. Brown bought 3 pounds of currants at 8¢ a pound. She gave the clerk 2 dimes and a nickel. What change should she get?

3. At 3¢ a yard, how much will 7 yards of braid cost? at 4¢ a yard? at 5¢? at 6¢?

4. Mr. Jones divided 18 boxes of figs equally among 6 children. How many boxes did each child get?

5. Irene had 9¢. She spent $\frac{1}{3}$ of her money, and gave another $\frac{1}{3}$ to her brother. What part of her money had she left? How many cents had she left?

6. A farmer sold half a bushel of pears to one man and a fourth of a bushel to another man. How many fourths in all did he sell?

7. How many quarters of a dollar make a dollar? a dollar and a quarter? a dollar and a half? a dollar and three quarters? two dollars?

8. Two halves of a pie were each cut into two equal parts. Henry ate one of those parts. What part of the whole pie was left?

9. Mary bought a yard of ribbon, and used $\frac{2}{3}$ of it. What part of the yard of ribbon was left?

10. Willie is twice as old as Charles. Willie is 14 years old. How old is Charles?

11. In an orchard there are 15 peach trees and 12 pear trees. How many trees are there in the orchard?

12. In a can there are 2 gallons of milk. How many pints are there?

20 AND 25

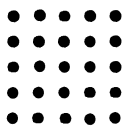
1. $2 \times 10 = ?$ $10 \times 2 = ?$ $20 \div 10 = ?$ $20 \div 2 = ?$

2. What is $\frac{1}{2}$ of 20? $\frac{1}{10}$ of 20? $\frac{2}{10}$ of 20? $\frac{3}{10}$ of 20? $\frac{4}{10}$ of 20? $\frac{6}{10}$ of 20? $\frac{8}{10}$ of 20? $\frac{9}{10}$ of 20?

3. What is the ratio of 20 to 10? of 10 to 20?

4. Edna bought a yard of lace for 18¢. She gave the clerk 2 dimes. What change should he give her?

5. How many dots are there in each of these rows? How many rows are there? How many dots are there in all?



6. $5 \times 5 = ?$ How many 5's are there in 25? How many 5's are there in 20?

7. What is the ratio of 25 to 5? of 20 to 5? of 5 to 20? of 5 to 25?

8. $25 \div 5 = ?$ $20 \div 5 = ?$ $10 \div 5 = ?$

9. At 5¢ each, how many cents will 5 oranges cost?

10. How many nickels equal a quarter of a dollar?

11. $7 + 8 + 10 - 5 = ?$ $25 - 5 - 5 - 5 = ?$

12. $1 + 17 - 10 - 5 + 2 = ?$ $23 - 3 - 5 + 4 + 1 = ?$

13. $16 + 4 + 5 - 6 - 4 = ?$ $24 - 3 - 2 + 6 = ?$

14. If one table costs \$5, how many dollars will 2 tables cost? How many \$5 in \$10?

15. What is the cost of 5 hats at \$4 each?

16. Ella has 25¢. How many paper dolls at 2¢ apiece can she buy?

17. How much money will she have left, after buying all the dolls she can at that price?

18. Multiply 1, 3, 7, 2, 9, 8, 4, 6, 5, 10, 12, 11, by 2.

19. Multiply 1, 4, 7, 9, 6, 8, 5, 3, 2, by 3.

20. Multiply 5, 2, 1, 4, 3, by 5.

QUESTIONS

1. $3+4+4+3=?$ $28-8-5-5=?$

$18-8-5-5=?$ $29-1-7-1=?$

$29-8+1-2-10-4-1=?$

$28-8+1+2+2-4-1=?$

$20-10+2-3+4-1+5-3=?$

$22-20+4+10-2-3+1-7=?$

$1+7+9+3+9-8-1-5-4-3=?$

2. Add:

5	3	2	3	9	5	7	5
11	1	6	7	1	4	2	8
1	4	2	4	4	3	3	6
2	7	1	2	3	6	6	7
1	2	5	1	6	5	1	3

3. Count from:

0 by 3's to 27	0 by 4's to 28	0 by 8's to 24
0 by 6's to 24	0 by 7's to 28	0 by 11's to 22
0 by 9's to 27	0 by 10's to 20	1 by 3's to 26
0 by 12's to 24	1 by 3's to 23	1 by 6's to 25
2 by 4's to 28	1 by 5's to 26	4 by 3's to 25
1 by 7's to 29	3 by 2's to 29	6 by 3's to 27
5 by 6's to 29	2 by 7's to 23	5 by 2's to 29
2 by 5's to 27	3 by 4's to 27	

4. How many:

2's in 8? 10? 16? 20? 14? 12? 24? 22?

3's in 9? 27? 18? 12? 24? 15? 21?

4's in 12? 24? 16? 20? 28?

5's in 10? 25? 15? 20?

6's in 18? 24? 12?

7's in 21? 14? 28?

8's in 24? 16? 8?

9's in 27? 18? 9?

10's in 20? 10?

11's in 22?

12's in 24?

1 TO 29

Copy and add by rows and columns:

1.

2	3	1	3	2	3
6	4	9	2	3	5
2	3	1	2	4	3
5	4	3	2	6	6
4	5	2	3	2	1
1	2	3	6	1	4
1	2	1	2	3	1

2.

3	3	1	4	6	2
2	5	7	2	3	4
4	1	2	6	1	5
2	7	3	1	2	1
1	1	1	8	5	2
8	7	6	5	1	2
2	3	5	2	5	4

Copy and complete:

3.	**4.**	**5.**	**6.**
$12 = \ ? \times 6$	$8 = ? \times 4$	$18 = ? \times 9$	$22 = 11 \times ?$
$14 = \ ? \times 7$	$28 = ? \times 7$	$15 = 5 \times ?$	$25 = \ 5 \times ?$
$10 = \ ? \times 5$	$12 = 4 \times ?$	$9 = 3 \times ?$	$16 = \ ? \times 4$
$20 = \ 5 \times ?$	$14 = ? \times 7$	$6 = 2 \times ?$	$18 = \ 2 \times ?$
$10 = \ 2 \times ?$	$12 = 3 \times ?$	$14 = 2 \times ?$	$18 = \ ? \times 6$
$20 = 10 \times ?$	$28 = 4 \times ?$	$27 = 3 \times ?$	$24 = \ ? \times 8$

7. $9 - 1 + 2 - 3 - 4 + 6 + 8 - 10 = —.$
$27 - 6 - 1 - 10 + 2 - 8 + 4 - 2 = —.$
$19 + 1 - 2 - \ 8 - 8 + 8 - 9 + 1 = —.$

8. $24 - 12 - 6 - 3 - 2 + 1 - 2 = —.$
$19 - 8 - 10 + 7 + 6 - 3 - 6 = —.$
$23 - 17 + 6 - 10 + 2 + 2 + 2 = —.$

9. $28 - 8 - 4 - 3 - 3 - 3 - 3 = —.$
$26 - 6 - 5 - 4 - 3 - 2 - 1 = —.$
$29 - 9 - 8 + 12 - 4 - 10 - 10 = —.$

10. Try these questions: $(25 \div 5) + 3 = ?$
$(5 \times 2) + 6 = ?$ $2 + (3 \times 6) = 10 \times ?$

REVIEW

We found that of the numbers below 20, these cannot be evenly divided by any other number,—1, 2, 3, 5, 7, 11, 13, 17, 19. Of the numbers 20 to 29, these cannot be divided by any other number, — 23, 29. By "evenly divided" we mean that the number can be divided with no units left over.

QUESTIONS

1. A table is 4 feet in length. A bench is 4 times as long. How long is the bench?

2. George is 27 years old. James is 6 years younger. How old is James?

3. If a gallon of water weighs 10 pounds, how many pounds will ten gallons of water weigh? How many pounds will half a gallon weigh? How many pounds will 1 quart weigh?

4. How many ounces are there in half a pound of meat?

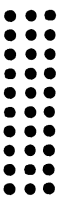
5.	6.	7.	8.	9.
$2 \times 9 = ?$	$2 \times 11 = ?$	$2 \times 3 = ?$	$2 \times 7 = ?$	$5 \times 5 = ?$
$2 \times 4 = ?$	$2 \times 8 = ?$	$2 \times 6 = ?$	$2 \times 10 = ?$	$6 \times 4 = ?$
$2 \times 2 = ?$	$2 \times 5 = ?$	$2 \times 12 = ?$	$3 \times 8 = ?$	$2 \times 5 = ?$
$6 \times 3 = ?$	$4 \times 5 = ?$	$3 \times 5 = ?$	$9 \times 2 = ?$	$2 \times 7 = ?$
$5 \times 5 = ?$	$2 \times 3 = ?$	$5 \times 2 = ?$	$4 \times 4 = ?$	$2 \times 2 = ?$
$3 \times 3 = ?$	$6 \times 4 = ?$	$2 \times 2 = ?$	$5 \times 4 = ?$	$3 \times 1 = ?$
$4 \times 7 = ?$	$3 \times 7 = ?$	$3 \times 2 = ?$	$2 \times 9 = ?$	$4 \times 6 = ?$
$4 \times 3 = ?$	$8 \times 2 = ?$	$2 \times 8 = ?$	$6 \times 2 = ?$	$3 \times 3 = ?$
$5 \times 3 = ?$	$3 \times 3 = ?$	$2 \times 5 = ?$	$7 \times 3 = ?$	$4 \times 2 = ?$
$8 \times 3 = ?$	$7 \times 2 = ?$	$2 \times 4 = ?$	$3 \times 4 = ?$	$4 \times 4 = ?$
$3 \times 6 = ?$	$7 \times 4 = ?$	$3 \times 9 = ?$	$2 \times 2 = ?$	$5 \times 3 = ?$

THE NUMBERS THIRTY TO NINETY-NINE

We call three tens **thirty** and four tens **forty**.

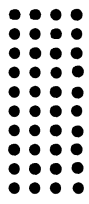
$10 + 10 + 10 = 30.$

$20 + 10 = 30.$



$10+10+10+10=40.$

$2 \times 20 = 40.$



We write thirty with 3 in tens' place and 0 in units' place.

We write forty with 4 in tens' place and 0 in units' place.

TABLE OF TENS, ADDING UNITS

● ● ● ● ● ● ● ● ● ●	10	+	●		=	11
● ● ● ● ● ● ● ● ● ●	20	+	● ●		=	22
● ● ● ● ● ● ● ● ● ●	30	+	● ● ●		=	33
● ● ● ● ● ● ● ● ● ●	40	+	● ● ● ●		=	44
● ● ● ● ● ● ● ● ● ●	50	+	● ● ● ● ●		=	55
● ● ● ● ● ● ● ● ● ●	60	+	● ● ● ● ● ●		=	66
● ● ● ● ● ● ● ● ● ●	70	+	● ● ● ● ● ● ●		=	77
● ● ● ● ● ● ● ● ● ●	80	+	● ● ● ● ● ● ● ●		=	88
● ● ● ● ● ● ● ● ● ●	90	+	● ● ● ● ● ● ● ● ●		=	99
● ● ● ● ● ● ● ● ●	99	+	●		=	100

We write nine, 9; ten, 10; nineteen, 19; twenty, 20; twenty-nine, 29; thirty, 30. Then we write forty, 40; fifty, 50; sixty, 60; seventy, 70; eighty, 80; ninety, 90; but after ninety-nine, 99, we write one hundred, 100.

1 ten is written 10; 2 tens are written 20; 3 tens, 30; 4 tens, 40; 5 tens, 50; 6 tens, 60; 7 tens, 70; 8 tens, 80; 9 tens, 90; but 10 tens are written 100.

QUESTIONS

1. If 20 barrels of apples cost $40, how much will 1 barrel cost?

2. Charles had 47¢. He paid 5¢ for car fare. How many cents had he left?

3. A grocer had 66 eggs. He sold half a dozen. How many eggs did he have left?

4. At 50¢ a dozen, how many oranges can you buy for 100¢, or $1?

5. I bought 9 rocking-chairs at $10 each, and 1 table for $8. How much money did I spend?

6. Mrs. Smith bought 3 pounds of coffee for 30¢ a pound, and 1 cake of soap for 5¢. She gave the clerk a dollar bill. What change should she get?

7. At 20¢ a dozen, what will be the cost of 4 dozens of eggs?

8. Ella bought 2 pounds of meat at 20¢ a pound. What change should she get out of a fifty-cent piece which she gave in payment?

9. A rug cost thirty dollars and a bookcase forty dollars. What was the cost of both articles?

10. If a train goes 30 miles in an hour, how many miles will it go in three hours?

11. I had 57¢ and spent 6¢. What had I left?

12. If a bushel of peas weighs 60 pounds, how many pounds does half a bushel weigh? How many pounds does a bushel and a half weigh?

13. A yard of silk cost $1. How many cents will half a yard cost?

14. George had 80¢. He spent $\frac{1}{4}$ of his money. How many cents did he spend?

REVIEW

1. Count forwards to 100, beginning at 1.

2. Count backwards to 1, beginning at 100.

3. Make tables of tens, adding various numbers of units.

4. Count to one hundred in writing, using words, not figures.

5. How many times are 2 contained in 10, 12, 24, 20, 16?

6. How many times are 3 contained in 9, 27, 15, 21, 18?

7. How many times are 4 contained in 16, 24, 20, 8, 12?

8. How many times are 5 contained in 10, 20, 15, 25?

9. How many times are 6 contained in 24, 12, 18?

10.	11.	12.	13.	14.
$12 \div 2 = ?$	$6 \div 3 = ?$	$24 \div 2 = ?$	$24 \div 3 = ?$	$24 \div 12 = ?$
$24 \div 4 = ?$	$15 \div 5 = ?$	$18 \div 3 = ?$	$12 \div 4 = ?$	$18 \div 2 = ?$
$20 \div 4 = ?$	$6 \div 3 = ?$	$8 \div 2 = ?$	$22 \div 11 = ?$	$16 \div 6 = ?$
$24 \div 6 = ?$	$10 \div 2 = ?$	$16 \div 2 = ?$	$25 \div 5 = ?$	$18 \div 6 = ?$
$21 \div 7 = ?$	$12 \div 3 = ?$	$28 \div 7 = ?$	$27 \div 9 = ?$	$20 \div 10 = ?$
$12 \div 1 = ?$	$10 \div 5 = ?$	$21 \div 3 = ?$	$22 \div 2 = ?$	$12 \div 12 = ?$
$24 \div 8 = ?$	$27 \div 3 = ?$	$28 \div 4 = ?$	$14 \div 7 = ?$	$20 \div 2 = ?$

15. Mr. Brown is 37 years old, and his son Fred is 6 years old. How many years older than Fred is his father?

16. Charles wants to buy a ball that costs 15¢. He has a dime. How many more cents does he need to buy the ball?

17. A teacher had 16 pens. She gave 10 of them to her pupils. How many pens did she keep?

18. From a ribbon 17 inches in length 13 inches were cut off. How many inches were left?

SUBTRACTING

73
28
45

Lay out 73 splints, 7 bundles of ten, and 3 loose splints. Untie 1 bundle, leaving 6 bundles tied. Add the untied 10 to the 3 loose splints, making 13 splints. Take 8 away from 13, 5 are left. Take 2 bundles away from the 6 bundles, 4 are left. 4 bundles of 10 splints and 5 loose splints are 45 splints. (4 tens and 5 units are 45.)

91
36
55

We cannot take 6 units from 5 units. We take 1 ten from the 9 tens, leaving 8 tens. 1 ten added to the 1 unit makes 11 units. 6 units from 11 units leave 5 units. We write the 5 in units' place below the line. 3 tens from 8 tens leave 5 tens. We write the 5 in tens' place below the line.

91	73	43	91	23	72	55	93	45	80
26	38	28	46	19	53	27	46	26	34
95	100	66	89	74	40	70	60	38	27
37	25	17	39	29	11	26	19	29	22
98	64	83	44	77	81	82	53	75	46
45	28	29	26	58	62	37	36	38	18

1. A peach orchard yielded 95 bushels of peaches. 68 bushels were sold. How many bushels were not sold?

2. In a school there were 87 pupils. 49 were boys. How many were girls?

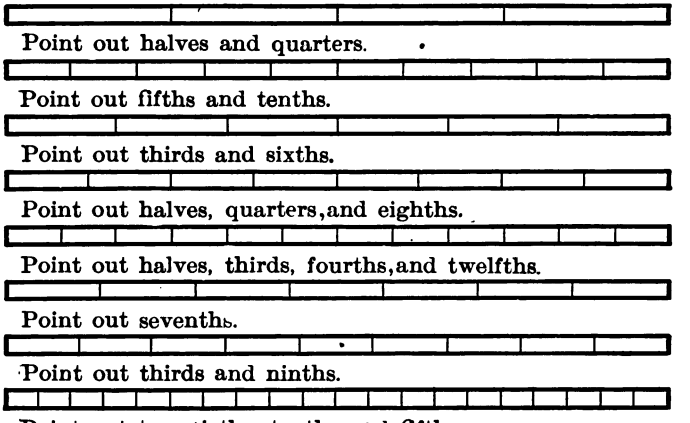
3. A man had $75. He paid $41 for a bicycle and $18 for a suit of clothes. How many dollars had he left?

4. There are 27 sheep in one pen and 22 in another. How many sheep in both pens? 19 of them were sold. How many sheep were left?

FRACTIONS

$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{12}$, are fractions. So also are $\frac{2}{3}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{2}{10}$, $\frac{3}{10}$, $\frac{4}{10}$, $\frac{5}{10}$, $\frac{6}{10}$, $\frac{7}{10}$, $\frac{8}{10}$, $\frac{9}{10}$. Read these.

When fractions are written in figures, the number below the line tells into how many parts the thing is divided, and the number above the line tells how many parts we are talking about. $\frac{5}{12}$ means that there are 12 equal parts, and we are taking 5 of them.



Point out halves and quarters.

Point out fifths and tenths.

Point out thirds and sixths.

Point out halves, quarters, and eighths.

Point out halves, thirds, fourths, and twelfths.

Point out sevenths.

Point out thirds and ninths.

Point out twentieths, tenths, and fifths.

1. Draw on the blackboard forms of figures showing halves, thirds, quarters, fifths, sixths, sevenths, eighths, ninths, tenths, twelfths, twentieths, and fortieths.

2. Tell why the larger the number of parts of anything, the smaller each part is.

3. What is $\frac{1}{2}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{4}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{5}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{5}$? $\frac{1}{4}$ of $\frac{1}{5}$? $\frac{1}{5}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{2}$ of $\frac{2}{6}$? $\frac{1}{2}$ of $\frac{3}{6}$? $\frac{2}{3}$ of $\frac{1}{2}$? $\frac{2}{3}$ of $\frac{1}{4}$?

4. Fold or cut paper to show $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{7}{10}$.

FRACTIONS

The equal parts of numbers are called *fractions.*

Fold or cut paper to show these facts.

1. $\frac{1}{2}$ of $6 = \frac{6}{2}$. Six halves are three wholes or units, because two halves equal one whole, and six are three times two. $\frac{6}{2} = 3$. $\frac{1}{2}$ of $6 = 3$. $\frac{1}{2} \times 6 = \frac{6}{2} = 3$.

2. $\frac{1}{2}$ of $8 = \frac{8}{2}$. $\frac{8}{2} = 4$. $\frac{1}{2}$ of $8 = 4$. $\frac{1}{2} \times 8 = 4$.

3. $\frac{1}{3}$ of $6 = \frac{6}{3}$. Six thirds are two wholes, or units, because three thirds equal one whole, and six are two times three. $\frac{6}{3} = 2$. $\frac{1}{3}$ of $6 = 2$. $\frac{1}{3} \times 6 = \frac{6}{3} = 2$.

4. $\frac{1}{3}$ of $9 = \frac{9}{3}$. $\frac{9}{3} = 3$. $\frac{1}{3}$ of $9 = 3$. $\frac{1}{3} \times 9 = 3$.

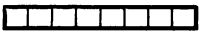
5. $\frac{1}{2}$ of $10 = ?$ **6.** $\frac{1}{2}$ of $12 = ?$ **7.** $\frac{1}{2}$ of $14 = ?$

8. $\frac{1}{2}$ of $16 = ?$ **9.** $\frac{1}{3}$ of $12 = ?$ **10.** $\frac{1}{3}$ of $15 = ?$

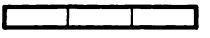
11. $\frac{1}{3}$ of $18 = ?$ **12.** $\frac{1}{3}$ of $21 = ?$

13. $\frac{2}{3}$ of $9 = ?$ $\frac{2}{3} \times 9 = \frac{18}{3}$ because 9 times two thirds are 18 thirds. $\frac{18}{3} = 6$, because $18 \div 3 = 6$.

14. $\frac{2}{3}$ of $12 = ?$ $\frac{2}{3} \times 12 = \frac{24}{3} = 8$.



15. $\frac{1}{4}$ of $8 = ?$ $\frac{1}{4} \times 8 = \frac{8}{4} = 2$.



16. Find $\frac{3}{4}$ of 8, $\frac{3}{4}$ of 12, $\frac{3}{4}$ of 16, $\frac{3}{4}$ of 20.

Count and see

17. Find $\frac{2}{5}$ of 10, $\frac{2}{5}$ of 15, $\frac{2}{5}$ of 20, $\frac{2}{5}$ of 25.

18. Find $\frac{3}{5}$ of 15, $\frac{4}{5}$ of 20, $\frac{3}{5}$ of 30, $\frac{2}{5}$ of 40.

19. What are $\frac{2}{3}$ of 18? 15? 6? 9? 21? 24? 27? 30?

20. Find $\frac{4}{5}$ of 20, 10, 15, 5, 25, 30, 35, 40.

21. Find $\frac{2}{6}$, $\frac{4}{6}$, and $\frac{5}{6}$ of 18, 6, 12, 24, 30, 36, 42, 48.

22. Find $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, and $\frac{6}{7}$ of 14, 7, 21, 28.

23. What are $\frac{2}{8}$, $\frac{3}{8}$, $\frac{4}{8}$, $\frac{5}{8}$, $\frac{6}{8}$, and $\frac{7}{8}$ of 16, 8, 24, 32, 40?

QUESTIONS

1. If a bushel of corn cost 80¢, what will 8 quarts cost? What will a peck cost?

2. If a quart of onions cost 9¢, how many cents will 3 quarts cost?

3. How many dimes equal 90¢?

4. A man bought 2 rugs at $9 apiece. What change should he get back, if he gave the clerk a twenty-dollar bill?

5. 45¢ was divided equally among 9 children. How many cents did each child get?

6. In 2 hours Fred can ride 30 miles on his wheel. How many miles can he ride in 1 hour? in 3 hours?

7. In a school of 84 children there were 12 over 9 years of age. How many children were under 9 years? What fraction tells the number of children over 9 years old?

8. Mr. Brown put into his pocketbook 6 ten-dollar bills, 3 five-dollar bills, and 4 two-dollar bills. How many dollars did he put into the pocketbook?

9. What is the ratio of 10 to 5?

10. If 5 oranges cost 20¢, how many cents will 10 oranges cost?

11. What is the ratio of 6 to 2?

12. If 2 pencils cost 8¢, what will 6 pencils cost?

13. Henry has 60¢ in nickels. How many car rides can he take at 5¢ a ride?

14. A baker sold 12 loaves of bread a 4¢ a loaf and a dozen of cookies for 8¢. How much money did he get?

15. Emma bought 3 paper dolls for 10¢, and Laura bought 2 skeins of thread for a nickel. How many cents did both girls spend?

QUESTIONS

1. $\frac{2}{4}$ of 8 = ? $\frac{1}{2}$ of 8 = ? $\frac{1}{2}$ of 20 = ? $\frac{2}{4}$ of 20 = ?
$\frac{1}{2}$ of 44 = ? $\frac{2}{4}$ of 44 = ? $\frac{1}{2}$ of 28 = ? $\frac{2}{4}$ of 28 = ?

2. One half equals how many fourths?

3. What is the ratio of 4 to 28? of 28 to 4?

4. Compare 4 with 36. 4 is $\frac{1}{9}$ of 36. Hence the ratio of 4 to 36 is $\frac{1}{9}$. What is the ratio of 36 to 4?

5. What is the ratio of 24 to 4? of 24 to 6? of 24 to 12?

6. Give the ratio of 4 to:

8, 32, 16, 40, 48, 44, 24, 20, 12, 4.

7. Give the ratio of each of those numbers to 4.

8. If a hat costs $4, what will a dozen hats cost?

9. Divide 24 pears equally among 6 boys. How many pears will each boy get?

10. There were 2 dozen eggs in a basket. One third of them were used for breakfast. How many were left?

11. James had 28¢. He spent $\frac{1}{4}$ of his money. How many cents had he left?

12. 3 tops cost 18¢. What was the price of one top?

13. Eddie bought 9 apples at 2¢ each. How many cents did he pay for them?

14. Katie got 4 spools of thread at 3¢ apiece. How many cents did she pay for the 4 spools?

15. George has 3 nickels. How many cents has he?

16. Alice had 14 cherries. She gave $\frac{1}{7}$ of them to Lucy. How many cherries did Lucy get?

17. It is 18 miles from Brooklyn to Garden City. I walked $\frac{1}{6}$ of that distance. How many miles did I walk? How many miles would be $\frac{2}{6}$ of the distance?

QUESTIONS

1. How many pints are there in $\frac{1}{5}$ of 5 gallons?

2. If syrup is 80¢ a gallon, how many cents must be paid for a pint?

3. What is the ratio of 2 to 6? 2 is what part of 6?

4. If 6 boxes of candy weigh 3 pounds, what will 2 boxes weigh?

5. What will 12 yards of cloth cost at $4 a yard?

6. When 8 pounds of sugar cost 40¢, 1 pound of sugar will cost $\frac{1}{8}$ of 40¢, or ——.

7. What is the ratio of 18 to 6? of 24 to 8?

8. When 7 yards of silk cost $21, a yard will cost $\frac{1}{7}$ of $21, or —— dollars. 4 yards will cost 4 × —— dollars, or —— dollars.

9. If 9 bushels of apples cost $18, 1 bushel will cost $\frac{1}{9}$ of $18, or —— dollars. 4 bushels will cost 4 × —— dollars.

10. If a dozen oranges cost 60¢, what will be the cost of 1 orange? of 3 oranges? of 5 oranges?

11. When 5 pounds of meat cost 45¢, what will 1 pound cost? 2 pounds?

12. When 5 quarts of milk cost 35¢, what will 2 quarts cost?

13. If 4 lemons cost 8¢, what will 1 lemon cost? 2 lemons? What will a dozen lemons cost? A half dozen?

14. If a newspaper costs 2¢, how many cents will 7 newspapers cost?

15. A man had 18 oranges. He divided them equally among 6 children. How many oranges did each child receive?

TELLING LENGTHS

12 inches make 1 foot.

12 in. = 1 ft.

in. stands for inch or inches. ft. stands for foot or feet.

3 feet make 1 yard.

3 ft. = 1 yd.

Be sure to place a period after in. for inch, ft. for foot, and yd. for yard.

A foot-rule shows twelve inches.

A yard-stick shows three feet.

A foot is a very common unit of measure. We buy boards at the lumber yard by the foot.

A yard is almost as common a unit of measure. We buy goods for dresses and suits by the yard.

An inch is the unit of measure for small things. We tell how wide and how long a photograph is by inches.

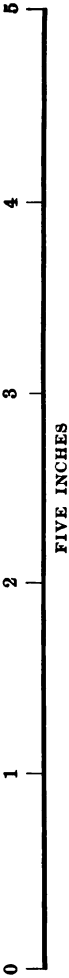
1. Measure 2 inches on a piece of paper with a ruler.

2. Cut squares 2 inches on each side.

3. Measure the size of the first picture in this book.

4. What is the size of your desk? Your teacher's desk?

5. Ask your mother how many yards of cloth she needs to make a dress. Measure that number of yards on the blackboard.



Size means, How long is it? and, How wide is it? sometimes also, How thick is it?

QUESTIONS

1. A bushel basket is half full of potatoes. How many more pecks of potatoes will it hold?

2. How many quarts are there in a bushel of chestnuts? in a bushel of corn? in a bushel of apples?

3. If a bushel of wheat weighs 60 pounds, how many pounds does a peck of wheat weigh?

4. 8 quarts are what part of a bushel? 2 pecks make what part of a bushel?

5. If 2 bushels of apples cost four dollars, what will 2 pecks cost?

6. How many bushels are there in 64 quarts?

7. How many bushels are there in 72 quarts?

8. Arthur gathered half a bushel of chestnuts. To how many boys can he give a quart each, after he has sold a peck of the nuts?

9. How many quarts are there in a bushel? in half a bushel? How many quarts are there in a quarter of a bushel? How many quarts in 2 quarters of a bushel? in $\frac{3}{4}$ of a bushel?

10. If you had $\frac{1}{8}$ of a bushel of berries, how many quarts would you have?

11. If a pint of walnuts costs 6 cents, what will 4 quarts cost? What will half a peck cost?

12. A dish holds 3 pints of berries. How many quarts will 6 such dishes hold?

13. At 9¢ a qt., what will a pk. of cranberries cost?

14. At 5 cents a quart, what will 1 peck of beans cost?

15. How many pecks are there in 9 bushels? in 6 bushels? in 3 bushels? in 5 bushels?

REVIEW

1. What are $\frac{2}{9}$ of 18? $\frac{3}{9}$? $\frac{4}{9}$? $\frac{5}{9}$? $\frac{6}{9}$? $\frac{8}{9}$?

2. What part of 9 is 1? $\frac{8}{9}$ of 9 = ? $\frac{1}{2}$ of 10 = ?

3. $\frac{5}{10}$ of 10 = ? $\frac{1}{2}$ of 20 = ? $\frac{5}{10}$ of 20 = ? $\frac{5}{10}$ of 100 = ?

4. A string was 12 yds. 1 ft. long. 2 yds. 1 ft. were cut off. How many yards were left? how many feet?

5. A tank contained 38 gallons of water. 62 gallons more were poured in. Then 47 gallons were pumped out. How many gallons were left?

6. A milkman has 7 cans, each holding 12 gallons of milk. He sells 48 gallons. How many gallons has he left?

7. James earned 40¢ in one week, and Arthur earned 55¢. How many cents did both boys earn?

8. If James spent 29¢, and Arthur spent 36¢, how many cents did each boy have left?

9. A man having $56 bought a suit of clothes for $28. What part of his money did he spend? How many dollars did he have left?

10. At 6¢ a quart, how much money will 6 pints of milk cost? 9 pints? 3 gallons?

11. At 4¢ a pint, how many pints of berries can you buy for 20¢? for 80¢

12. How many inches long is your shoe? How long are your skates?

13. How many feet or inches wide is the ring you use for marbles?

14. If a bushel of peaches costs four dollars, how much will a peck cost?

15. What will a bushel of potatoes cost at 20¢ a peck?

QUESTIONS

1. How many inches are there in a quarter of a yard? in $\frac{3}{4}$ of a yard? in $\frac{1}{2}$ of a yard?

2. Harriet bought a yard of ribbon and divided it equally, for dress trimming, among her six dolls. How many inches of ribbon did she cut off for each doll?

3. If you drew a line a foot long and divided it into 12 equal parts, what would be the name of any of those parts?

4. George drew a triangle that was $\frac{1}{4}$ of a foot on each side. How many inches was it around the triangle?

5. How many inches are there in $\frac{1}{6}$ of a foot?

6. How many inches is it around a desk top 2 feet long and 18 inches wide?

7. A ribbon was 3 feet in length. How many inches long was it?

8. If it takes 7 yards of lace to trim a dress, how many yards will it take to trim 9 dresses?

9. A log of walnut was 30 feet long, $\frac{1}{3}$ of it was cut off. How many feet were cut off?

10. Mrs. Smith bought 10 yards of silk at $1 a yard. She used $\frac{1}{2}$ of the silk. How many yards were left? What was the value of the piece of silk she used?

11. A bench is 12 feet long and 16 feet wide. How many yards is it half way around the bench?

12. How many feet are there in 28 inches? How many inches over?

13. A square room has sides 5 yards and 1 foot long. How many feet is it around the room?

14. A string 1 foot long is to be cut into inch pieces. How many times must it be cut?

QUESTIONS

1. Draw a rectangle 2 inches wide and 4 inches long. Divide it into 1-inch squares. How many squares are there in the oblong?

2. A room is 3 yards and 1 foot wide. How many steps will a boy take in crossing the room if he steps 2 feet at each step?

3. Measure the distance between 2 windows in your room. Measure the length and the width of the room.

4. In a room the distance between a door and a window was measured and found to be 3 yards and 1 foot. How many feet were there in that distance?

5. Louise bought a roll of braid, and, on measuring it, found that there were 9 feet in the roll. How many yards were there in it?

6. Mrs. Smith bought 9 yards of silk. She used $\frac{1}{3}$ of it. How many feet were in the piece she used?

7. Draw a square with sides 3 inches long. Mark the inches on its sides. Divide the square into 9 smaller squares.

8. Draw a rectangle 1 inch wide and 4 inches long. How many 1-inch squares can you make in it?

9. On the board make 2 dots, 1 foot apart, guessing the distance. Measure the distance between the dots.

10. Judge a distance of 1 yard, making the distance by putting 2 dots on the board. Measure the distance guessed.

11. Draw a line that you think is 3 inches long. Measure it.

12. Draw a square that you judge to be $\frac{1}{2}$ of a foot in length. Measure the square.

HUNDREDS

We call ten tens one hundred.

$10 \times 10 = 100$ $\quad 99 + 1 = 100$ $\quad 50 + 50 = 100$

We write one hundred in figures, 100. We put the 1 in hundreds' place by setting two zeros, 00, at the right to show that the 1 is neither in units' place nor in tens' place.

We call twenty tens two hundred, and write two hundred in figures with a 2 in hundreds' place.

$100 + 100 = 200$ $\quad 20 \times 10 = 200$

Two hundred and one hundred are three hundred.

$100 + 100 + 100 = 300$ $\quad 200 + 100 = 300$

Four hundred, 400. Five hundred, 500.

Six hundred, 600. Seven hundred, 700.

Eight hundred, 800. Nine hundred, 900.

Above one hundred we count units and tens as we do below one hundred.

We write one hundred eleven in figures, 111.

We write six hundred ninety-two in figures, 692.

1. $90 + 11 = 101$. $11 = 10 + 1$. Nine tens and one ten make ten tens. Ten tens are one hundred. The unit we set in units' place.

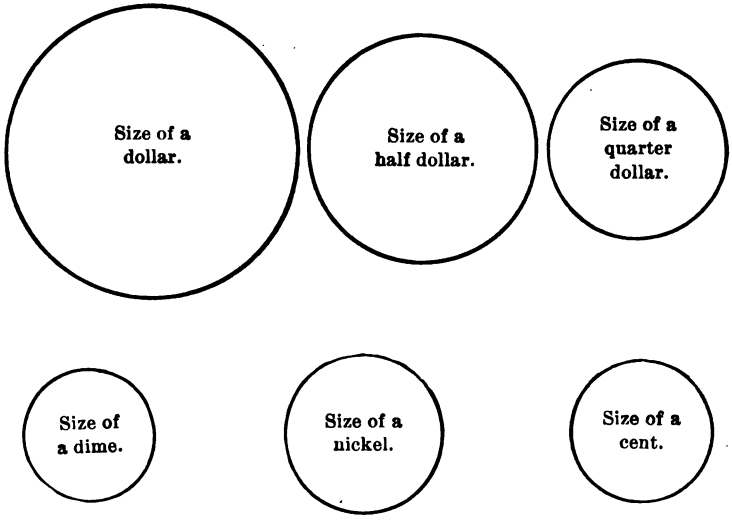
2. $84 + 20 = 104$. $84 = 80 + 4$. Eight tens and two tens make ten tens. Ten tens are one hundred. The four we set in units' place.

3. $70 + 42 = 112$. $42 = 30 + 10 + 2$.

ADDITION

24	27	19	36	28	49	36	42
10	14	21	17	12	14	21	3
31	36	18	37	34	6	9	55
13	24	31	44	51	46	21	24
12	11	19	6	22	11	13	14
40	16	8	22	38	9	16	12
17	16	11	18	31	27	14	18
13	19	31	22	48	33	15	13
60	34	29	33	17	6	16	19
14	29	35	14	24	17	14	101
31	40	7	24	16	20	31	2
22	18	22	14	12	31	19	13
60	11	13	6	8	19	20	17
8	13	19	26	13	11	20	17
12	20	31	10	21	23	8	24
5	2	4	19	21	28	21	23
14	8	14	22	27	14	12	8
3	2	3	2	1	20	3	1
41	33	10	66	31	25	3	7
11	27	16	10	13	13	41	2
19	3	21	5	14	12	4	3
7	2	37	3	27	21	21	5
2	5	12	14	10	17	3	66
7	12	46	16	26	18	15	14
19	12	21	17	9	8	17	60
32	6	10	5	30	2	20	0
100	8	17	2	15	37	31	72
18	7	6	38	10	21	19	8

METAL MONEY



One dollar is equal to one hundred cents.

$ is the sign for one dollar, or 100 cents.

A half dollar is half 100 cents, or 50 cents.

A dime is one tenth of one dollar. $100 \div 10 = 10$.

A dime is worth ten cents.

A quarter dollar is equal to a fourth, or quarter, of 100 cents, or 25 cents. ¢ is the sign for cents.

The coins for dollars, half dollars, quarter dollars, and dimes are made of nearly pure silver metal by *Our Country*. That is one important thing Our Country, whose flag we know so well, does for us.

A nickel is equal to five cents, or 5¢.

The cent is one hundredth part of one dollar.

$\$1 = 100¢$. $100¢ \div 100 = 1¢ =$ one cent.

Nickels are made of nickel metal. Cents are made of copper.

NUMBER-STORIES

1. Mary and Tom are at the grocery. They have three quarters to spend. Mother wishes them to ask the grocer for three pounds of sugar, half a pound of tea, and a dozen eggs. Mr. Grocerman tells them that sugar is five cents a pound, tea is forty cents a pound, and eggs are twenty-five cents a dozen. Tom will carry the things home in the basket. Why does the grocer weigh the sugar? When Mary takes the "change," or money he gives back to her with the packages and the eggs, how many cents does she have to take home to mother?

3 quarters = three 25¢ pieces of silver. $3 \times 25¢ = 75¢$.

3 pounds of sugar at 5¢ a pound cost three times 5¢. $3 \times 5¢ = 15¢$.

$\frac{1}{2}$ pound of tea at 40¢ a pound costs one half of 40¢. $\frac{1}{2}$ of $40¢ = 20¢$. The eggs cost 25¢.

$$15¢ + 20¢ + 25¢ = 60¢ \qquad 75¢ - 60¢ = 15¢$$

Mary has fifteen cents to take back to her mother.

Do you see now why we have to learn about numbers?

2. Tell a number-story about Charlie and Susan. They have fifty cents. They wish to buy two pounds of sugar at five cents a pound, a loaf of bread at eight cents, and a pound of butter at twenty-eight cents. How much will they have left?

3. Make up a story about Willie and Jennie, who have one hundred cents. They ask Mr. Grocerman for half a dozen eggs, two pounds of butter, and three large loaves of bread. He asks them twenty-eight cents a dozen for his very best eggs and twenty-eight cents a pound for table butter and ten cents for large loaves of bread. They gave him a silver dollar. Was this right?

QUESTIONS

1. What is the ratio of 12 to 6? of 6 to 12? of 36 to 6? of 24 to 6? of 72 to 6? of 48 to 6? of 54 to 6? of 18 to 6? of 30 to 6? of 42 to 6? of 6 to 18? of 6 to 24? of 6 to 42? of 6 to 36? of 6 to 48? of 6 to 54? of 6 to 72?

2. If 6 dozen apples cost 72¢, how many cents will 1 dozen cost?

3. How many minutes past the hour is it when the minute hand points to III? 15 minutes are what part of an hour? 30 minutes are what part of an hour?

4. A farm of 72 acres is one sixth woodland. How many acres are woodland?

5. A table is 48 inches long and 36 inches wide. How many inches is it around the table?

6. What will 6 apples cost, if 4 dozen cost 96¢?

7. The price of a sofa was $66. It was reduced $\frac{1}{3}$ in price and was then sold. What was the selling price?

8. A woman had 5 ten-dollar bills and 3 two-dollar bills. She bought 8 yards of velvet at $6 a yard and 1 yard of silk for $3. How many dollars did she spend? How many dollars did she have left?

9. A grocer paid $60 for 30 barrels of apples. What was the cost a barrel? He sold the apples for $90. How much did he get a barrel? How much did he gain on each barrel? How much did he gain on the 30 barrels?

10. A pail holds 12 quarts. How much will it cost to fill it with milk at 6¢ a quart? After $\frac{5}{6}$ of the milk is used, how many pints are left?

11. In one day Mr. Smith rode 80 miles on his wheel. He rode $\frac{1}{8}$ of the distance in half an hour. How many miles did he ride in that time?

READING AND WRITING HUNDREDS

Hundreds	Tens	Units
7	0	0
	7	0
		7
7	7	7

Hundreds	Tens	Units
4	0	0
	2	0
		2
4	2	2

Hundreds	Tens	Units
4	0	0
	5	0
		1
4	5	1

Hundreds	Tens	Units
9	0	0
	8	0
		7
9	8	7

1. Read the numbers: 299, 643, 110, 444, 770, 801, 999.

2. How many more hundreds has 897 than 153? how many more tens has 897? how many more units?

3. Tell how many hundreds, how many tens, and how many units there are in:

393	406	744	985	112	630	808	299	681
515	600	401	642	371	755	433	691	717
350	404	199	878	555	802	576	603	979
611	225	111	226	414	901	584	717	205
660	218	922	660	832	961	321	201	1000

4. Write by figures:

One hundred twenty-five.
One hundred ninety-nine.
One hundred six.
Two hundred forty-six.
Two hundred eighteen.
Two hundred two.
Three hundred eleven.
Three hundred thirteen.
Four hundred twenty-eight.
Four hundred eighty-one.
Four hundred ninety.
Five hundred five.
Five hundred fifty-five.
Six hundred ninety.
Six hundred eight.
Seven hundred seventeen.
Seven hundred seven.
Eight hundred forty-eight.
Eight hundred thirty-six.
Nine hundred twenty-one.
Nine hundred fifty.
Nine hundred ninety-one.

REVIEW OF HUNDREDS

1. Write these numbers in figures: 7 hundreds. 7 hundreds 2 tens 8 units. 3 hundreds 6 tens 7 units. 4 hundreds 1 ten 1 unit. 8 hundreds 5 tens 5 units. 2 hundreds 3 tens 2 units. 1 hundred 4 tens 3 units. 5 hundreds 7 tens 4 units. 9 hundreds 8 tens 6 units. 3 hundreds 1 unit. 6 hundreds 5 tens 2 units.

2.

$220 = 110 + ?$	$345 = 140 + ?$	$725 + ? = 930$
$425 = 200 + ?$	$250 = 40 + ?$	$525 + ? = 835$
$630 = 220 + ?$	$610 + ? = 820$	$330 + ? = 640$
$535 = 130 + ?$	$115 + ? = 720$	$835 + ? = 940$
$840 = 235 + ?$	$200 + ? = 325$	$749 + ? = 957$

3. How many 10's are there in 200? 300? 400? 500? 600? 700? 800? 900? 1000?

2 tens $\times$ 5 = ?	5 $\times$ 2 tens = ?	2 tens $\times$ 6 = ?
6 tens $\times$ 2 = ?	4 $\times$ 4 tens = ?	4 tens $\times$ 4 = ?
5 tens $\times$ 5 = ?	6 tens $\times$ 8 = ?	5 $\times$ 5 tens = ?
8 $\times$ 6 tens = ?	3 tens $\times$ 9 = ?	3 $\times$ 9 tens = ?
4 tens $\times$ 8 = ?	6 tens $\times$ 6 = ?	8 tens $\times$ 4 = ?
6 tens $\times$ 6 = ?	7 tens $\times$ 2 = ?	7 $\times$ 2 tens = ?

4. How many figures are needed to express units, or ones? to express tens? to express hundreds?

5. Write a 10's Table to 1000, in ten parts, 1 to 100, 101 to 200, 201 to 300, 301 to 400, 401 to 500, 501 to 600, 601 to 700, 701 to 800, 801 to 900, 901 to 1000.

HOUSE NUMBERS

In towns and cities the streets are named, and the houses and lots on the streets are numbered. One side of the street has odd numbers, and the other side has even numbers. If there is room between houses for more houses, then these lots, sometimes called vacant lots, are numbered.

Has your house a number, and your street a name?

If you live in the open country where there is plenty of room, and people do not need names for their roads and numbers for their houses, probably you know where some townspeople have their houses or stores.

The name of the street and the number of the house are part of the **address**. Mr. William Jones, 165 Main Street.

Sometimes when there are very many streets, the streets have numbers for names. When we wish to write a letter to a person living in a different place from our own town or city, we tell the post-office clerks what the place is where we wish the letter to go.

Master Charles Marshall,
149 Sixth Street,
Atlanta,
Georgia.

If houses were not numbered in large towns and cities, it would take a great deal of time to find people in them.

1. Write your house address or that of some friend.

2. Exchange your paper with its address for that of the boy or girl in front of or behind you. Read that, and copy it. Exchange across the aisle.

3. Has your schoolhouse any address?

4. Where is your town or city hall? Your post office?

THOUSANDS

We call ten hundreds **thousands.**

$10 \times 100 = 1000$ $\quad 999 + 1 = 1000$ $\quad 500 + 500 = 1000$

We write one thousand in figures, 1000. We put the 1 in thousands' place by setting three zeros, 000, at the right to show that the 1 is neither in units' place nor in tens' place nor in hundreds' place.

We call twenty hundreds two thousand; and write two thousand in figures with a 2 in thousands' place.

$1000 + 1000 = 2000$ $\quad 20 \times 100 = 2000$

Two thousand and one thousand are three thousand.

$1000 + 1000 + 1000 = 3000$ $\quad 2000 + 1000 = 3000$

We write four thousand 4000, five thousand 5000, six thousand 6000, seven thousand 7000, eight thousand 8000, nine thousand 9000.

Ten tens we call one hundred. Ten hundreds we call one thousand. Ten thousands we call ten thousands. One hundred thousand we call one hundred thousand.

We write one hundred 100. We may write one thousand 1,000. The comma is to help us see that there are 3 zeros, and to read thousands quickly. We write ten thousand 10000. We write one hundred thousand 100,000. It is not necessary to use a comma.

1. $900 + 101 = 1001$. $101 = 100 + 1$. Nine hundreds and one hundred are ten hundreds or one thousand.

2. $700 + 420 = 1120$. $420 = 300 + 120$. Seven hundreds and three hundreds are one thousand. The twelve tens we write as one hundred twenty.

THOUSANDS

1. One thousand one, 1001. One thousand nine, 1009.
One thousand ten, 1010. One thousand eighteen, 1018.
One thousand one hundred eighteen, 1118.
Two thousand seven hundred four, 2704.
Three thousand thirty-six, 3036.
Five thousand six hundred sixty, 5660.
Seven thousand seven hundred seventy-seven, 7777.
Eight thousand one hundred one, 8101.
Eight thousand eight hundred fifteen, 8815.
Nine thousand four hundred ninety-seven, 9497.

2. Read: 1246, 9223, 4780, 6111, 4644, 8707, 3136, 4598, 9610, 7000, 3688, 2080, 6202, 7100, 8004, 9110, 7333, 9909, 4707, 8118, 7656, 8771, 4919, 7223, 2743, 4339, 4716, 3188, 7007, 3010.

3. Write by figures: one thousand two hundred sixteen; three thousand seven hundred twenty-eight; nine thousand four hundred sixty-three; seven thousand seven hundred; eight thousand nine hundred seventy; two thousand seventy-five; four thousand four; six thousand six hundred sixty-six; nine thousand ten; eight thousand; three thousand one hundred forty-four; five thousand eight hundred eighty-one.

4. Write in words: 7414, 3602, 8433, 1014, 5005, 2110, 6116, 9711, 4419, 2829, 1990, 3333, 5208.

5. Give the number of thousands, of tens, and of ones in each of the numbers in 2 and 4.

6. Count by hundreds from 1000 to 2000.

7. Count by thousands from 2000 to 9000.

8. What is the greatest number that can be expressed by three figures? by four figures?

FIVES AND TENS

5 10 15 20 25 30 35 40 45 50 55 60

$0+5=5$	$5+5=10$	$10+5=15$
$15+5=20$	$20+5=25$	$25+5=30$
$30+5=35$	$35+5=40$	$40+5=45$
$45+5=50$	$50+5=55$	$55+5=60$

$5 \times 1 = 5$	$5 \times 7 = 35$
$5 \times 2 = 10$	$5 \times 8 = 40$
$5 \times 3 = 15$	$5 \times 9 = 45$
$5 \times 4 = 20$	$5 \times 10 = 50$
$5 \times 5 = 25$	$5 \times 11 = 55$
$5 \times 6 = 30$	$5 \times 12 = 60$

MULTIPLICATION TABLE OF FIVES

Make a division table, beginning it like this:

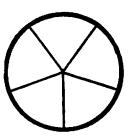
$5 \div 5 = 1$	$15 \div 5$				
$10 \div 5 = 2$	$20 \div$				

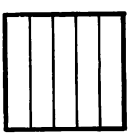
$10 \times 1 = 10$	$10 \times 7 = 70$
$10 \times 2 = 20$	$10 \times 8 = 80$
$10 \times 3 = 30$	$10 \times 9 = 90$
$10 \times 4 = 40$	$10 \times 10 = 100$
$10 \times 5 = 50$	$10 \times 11 = 110$
$10 \times 6 = 60$	$10 \times 12 = 120$

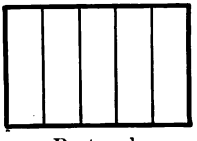
MULTIPLICATION TABLE OF TENS

FIFTHS AND TENTHS

When anything is divided into five equal parts, we call each part one fifth. Five fifths make one whole.

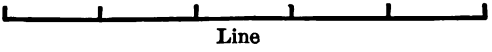

Circle

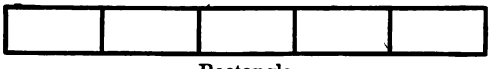

Square


Rectangle


Pentagon


Star

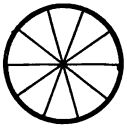

Line

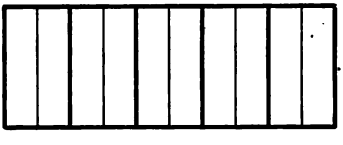

Rectangle

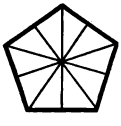
Into how many equal parts is each of these forms divided?

1. Point out two fifths of each of these forms; three fifths; four fifths.
2. Make drawings like these forms on paper, but larger.
3. Make drawings like these forms on the blackboard.

When anything is divided into tenths, it has ten equal parts. Ten tenths make one whole.

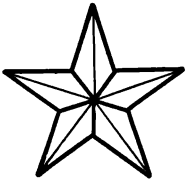






Into how many parts is each of these forms divided? Count and show the parts.

Make drawings like these forms both on paper and on blackboard.



SIXES AND TWELVES

6 12 18 24 30 36 42 48 54 60 66 72 78 84 90 96

0 + 6 = 6	6 + 6 = 12	12 + 6 = 18	18 + 6 = 24
24 + 6 = 30	30 + 6 = 36	36 + 6 = 42	42 + 6 = 48
48 + 6 = 54	54 + 6 = 60	60 + 6 = 66	66 + 6 = 72

6 × 1 = 6	6 × 7 = 42
6 × 2 = 12	6 × 8 = 48
6 × 3 = 18	6 × 9 = 54
6 × 4 = 24	6 × 10 = 60
6 × 5 = 30	6 × 11 = 66
6 × 6 = 36	6 × 12 = 72

MULTIPLICATION TABLE OF SIXES

12 24 36 48 60 72 84 96 108 120 132 144

0 + 12 = 12	12 + 12 = 24	24 + 12 = 36	36 + 12 = 48
48 + 12 = 60	60 + 12 = 72	72 + 12 = 84	84 + 12 = 96
96 + 12 = 108	108 + 12 = 120	120 + 12 = 132	132 + 12 = 144

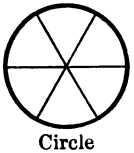
Make up bundles of splints, each with twelve splints, and show that these facts are true.

12 × 1 = 12	12 × 7 = 84
12 × 2 = 24	12 × 8 = 96
12 × 3 = 36	12 × 9 = 108
12 × 4 = 48	12 × 10 = 120
12 × 5 = 60	12 × 11 = 132
12 × 6 = 72	12 × 12 = 144

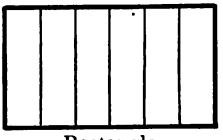
MULTIPLICATION TABLE OF TWELVES OR DOZENS

SIXTHS AND TWELFTHS

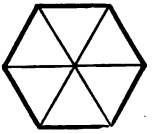
When anything is divided into six equal parts, we call the parts sixths. Six sixths make one whole.



Circle



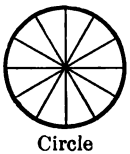
Rectangle



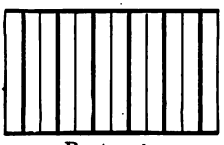
Hexagon

1. Show that each of these forms is divided into halves.
2. Show that each is divided into thirds; into sixths.
3. Make larger drawings of each of these forms on paper; on the blackboard.

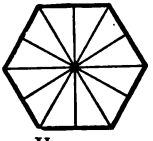
When anything is divided into twelve equal parts, we call the parts twelfths. Twelve twelfths make one whole.



Circle



Rectangle



Hexagon

1. Show the various halves in the circle and hexagon.
2. Show thirds of each of these forms.
3. Show fourths of each.
4. Show sixths of each.
5. Make larger drawings of each of these forms on paper; on the blackboard.
6. $\frac{6}{6} = 1$; $\frac{12}{12} = 1$; $\frac{3}{3} = 1$; $\frac{4}{4} = 1$. Read these facts.
7. Which is larger, $\frac{1}{3}$ or $\frac{1}{6}$? Why? $\frac{1}{6}$ or $\frac{1}{12}$? Why?
8. Cut out forms to show the answers to 6 and to 7.
9. Which is larger, $\frac{1}{6}$ or $\frac{2}{12}$? $\frac{2}{6}$ or $\frac{1}{3}$? $\frac{1}{3}$ or $\frac{4}{12}$?

DIVISION TABLES

Make a division table, beginning it like this:

10 ÷ 10 = 1	30 ÷ 10 = 3				
20 ÷ 10 = 2	40 ÷				

Make a division table, beginning it like this:

6 ÷ 6 = 1	18 ÷ 6 =				
12 ÷ 6 = 2	24 ÷				

Make a division table, beginning it like this:

12 ÷ 12 = 1	36 ÷ 12 = 3				
24 ÷ 12 = 2	48 ÷ 12 =				

QUESTIONS

1. How many school days are there in 4 weeks? How many working days?

2. How many hours are there in a quarter of a day?

3. Which is the greater fraction, $\frac{1}{4}$ or $\frac{1}{5}$?

4. A cake is cut into sevenths. Another cake of equal size is cut into tenths. Would one of these sevenths be a larger or smaller piece of cake than a tenth?

5. How many 10's are there in 96? how many units?

6. If a can of peaches cost 25¢, how many cans will $1 buy? 75¢?

7. What is the ratio of 6 to 48?

8. If 2 yards of tape cost 24¢, what will 1 yard cost? what will $\frac{1}{4}$ of a yard cost?

9. A strip of carpeting is $\frac{3}{4}$ of a yard wide. How many inches wide is the carpeting?

QUESTIONS

1. If you had a fifty-cent piece, a dime, and 2 nickels, how many cents would you have? How many more cents would you need to make a dollar?

2. A dealer paid $96 a dozen for lamps. What was the cost of 1 lamp?

3. A girl bought 8 yd. of braid at 6¢ a yd. She gave the clerk a 50¢ coin. What change should she get?

4. How many nickels are equal to 40¢?

5. How many cents are there in a dollar?

6. If a blank book cost 7¢, how many blank books can you buy with 3 dimes? How many cents would you have left after paying for the books?

7. Louis bought half a dozen little flags at 12¢ apiece. He gave the clerk a half dollar and a silver quarter. What change should the clerk give Louis?

8. A boy works in a garden at 10¢ an hour. How many hours must he work in order to earn $1?

9. What is the ratio of 6 to 12? of 9 to 27?

10. If a dozen oranges cost 50¢, how much will half a dozen cost? two dozen?

11. A man bought a pound of cheese for 15¢. He ate $\frac{1}{5}$ of it. What was the value of the part he ate?

12. At $6 a ton, how many tons of coal can you buy for $27? What will half a ton cost?

13. What is the ratio of 18 to 36? of 36 to 18?

14. If 36 crates of peaches cost $40, what will 18 crates cost? How many crates would $80 buy?

15. Mrs. Brown bought 9 yards of sheeting at 7¢ a yard and 3 yards of calico at 5¢ a yard. She gave the clerk a dollar bill. What change should she get?

REVIEW

1. $700+420=1120$. $420=400+20$. Seven hundred and four hundred are eleven hundred. We write twenty in tens' place.

2. Add:

950	800	700	800	900	850	880	990
100	250	600	750	950	600	900	400

3. Write in figures two thousand three hundred fifty-six, four thousand nine hundred ninety, six thousand two hundred sixty-two, eight thousand eight hundred.

4. Which is larger, $\frac{2}{10}$ or $\frac{1}{5}$? $\frac{4}{10}$ or $\frac{2}{5}$? $\frac{6}{10}$ or $\frac{3}{5}$? $\frac{8}{10}$ or $\frac{4}{5}$? Show the answers by drawing forms.

5. Can you tell which is larger, one tenth or one twentieth of anything? Do you see that equal parts grow smaller as the number-names grow higher? Ten is higher than four, but one tenth is smaller than one fourth. Why?

6. Compare $\frac{1}{3}$ and $\frac{1}{4}$ by drawings. $\frac{1}{4}$ and $\frac{1}{6}$. $\frac{1}{2}$ and $\frac{1}{12}$.

7. Compare $\frac{2}{3}$ and $\frac{3}{4}$. How much larger is the $\frac{3}{4}$? Show your answer by a rectangle divided into twelfths.

8. What is the ratio of 8 to 16? of 12 to 24?

9. If 16 pounds of oatmeal cost 40¢, what will 8 pounds cost? 12 pounds?

10. Mr. Brown bought 4 dozen pears. 3 of the pears were bad. The goods ones were divided equally among 9 children. How many pears did each child get?

11. From a door to a window the distance is 2 yards and 1 foot. How many feet is the distance?

12. Carrie bought a yard and a quarter of red ribbon and $\frac{3}{4}$ of a yard of white ribbon. How many yards in all did she buy?

QUESTIONS

1. Divide each of these numbers by 6, by 3, and by 2: 18, 12, 42, 36, 54, 48, 6, 84, 96, 72, 24, 60, 30, 66, 90, 78.

2. Find $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, and $\frac{5}{6}$ of each of the following numbers: 60, 30, 36, 72, 18, 54, 48, 42, 24, 84, 96.

3. $\frac{2}{6}$ of 30 = ? $\frac{1}{3}$ of 30 = ? Then $\frac{2}{6}$ = what other fraction? Show by a drawing.

4. $\frac{3}{6}$ of 18 = ? $\frac{1}{2}$ of 18 = ? Then $\frac{3}{6}$ = what other fraction? Show by a drawing.

5. $\frac{1}{3}$ of 12 = ? $\frac{2}{3}$ of 12 = ? $\frac{1}{6}$ of 12 = ? $\frac{4}{6}$ of 12 = ? Then $\frac{2}{3}$ = what other fraction?

6. How many sixths of a number equal one third of the number? How many sixths equal one half?

7. How many fourths and sixths are in two?

8. $\frac{1}{3}$ of 18 = ? $\frac{2}{6}$ of 18 = ? $\frac{2}{3}$ of 18 = ? $\frac{4}{6}$ of 18 = ?

9. Two thirds of 18 equal how many sixths of 18?

10. Two thirds of 30 equal how many sixths of 30?

11. $\frac{1}{2}$ of 24 = ? $\frac{3}{6}$ of 24 = ? One half of 24 equals how many sixths of 24?

12. $\frac{2}{3}$ of 36 = ? $\frac{4}{6}$ of 36 = ? How many thirds of 36 equal four sixths of 36?

13. One half of 24 equals how many sixths of 48?

14. One third of 42 equals how many sixths of 42?

15. One half of 54 equals how many sixths of 54?

16. One third of 54 equals how many sixths of 54?

17. $\frac{1}{3}$ of 60 = ? $\frac{2}{6}$ of 60 = ? $\frac{1}{2}$ of 60 = ? $\frac{3}{6}$ of 60 = ?

18. Draw illustrations to show $\frac{5}{6}$, $\frac{3}{8}$, $\frac{7}{9}$, $\frac{5}{12}$.

DATES

There are always seven days in every week. There are always at least four weeks or twenty-eight days in every month. There are twelve months in every year. A hundred years make one century. We are living in the twentieth century, because it is more than 1900 years since Jesus Christ was born. When we write letters we put three facts at the top, called the date. We tell the year, the month, and the day of the month: sometimes we tell also the day of the week. We may write the date, January 1, 1900, or Tuesday, Jan. 1, 1900. The calendar tells us how to know the month, the day of the month, the year, and the day of the week.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

This calendar is true for any month when the first day of the month falls on Sunday and when the month has 31 days. This calendar represents December, 1901, and March, 1903. If the 31st day were omitted, it would represent June, 1902, and November, 1903, also.

The names of the months are: January, February, March, April, May, June, July, August, September, October, November, December.

The year has 365 days, except "leap year," which has 366 days. Leap year comes every four years; then February gains another day.

Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Excepting February alone.
Twenty-eight are all its store
Till leap year gives it one day more.

Until the year 2400 every year we can divide by 4 will be leap year. We usually call thirty days a month unless we know the exact month in question.

THE CALENDAR

1. Get a calendar for the present year. On what week day did the first day of this month fall? On what week day will the first days of all the rest of the months of the year fall? On what week day did the first days of the past months fall?

2. Can you find what months of each year usually have the same days of the months on the same days of the week? Why is this not true in leap year?

3. Tell the names of the longest months.

4. How many days are there in seven weeks? in three weeks? in eleven weeks?

5. How many weeks are there in thirty-five days? in forty-nine days? in eighty-four days?

6. Which is the longer time, six weeks or two months? ten weeks or three months? one hundred days or three months?

7. Make a rectangle upon a sheet of paper seven inches long, five inches high. Mark the inch spaces on it on each side. Draw lines across and up and down so as to make thirty-five squares, one inch on each side.

8. Cut out thirty-one squares; number them from 1 to 31.

9. Place these squares on the sheet of paper to show the present month. Write at the top of the calendar, S for Sunday, M for Monday, T for Tuesday, W for Wednesday, T for Thursday, F for Friday, S for Saturday.

10. Make a large monthly calendar on the blackboard.

11. Make with the squares, as in 1 above, a calendar for the next month; the last month.

12. Make February of this year; of the next leap year.

TELLING TIME

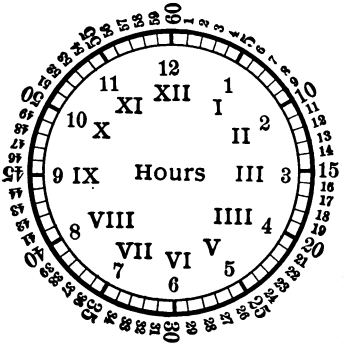
There are 24 hours in every day. The first hour begins halfway between sunset and sunrise, when the night is darkest. We call the end of one day and the beginning of the next day *midnight*. Then we count 12 hours, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. When it is twelve o'clock in the daytime in March and September, it is halfway between sunrise and sunset. Then we begin again, and count 1, 2, 3, to 12, midnight.

Twenty minutes past eight o'clock

Noon means 12 o'clock in the daytime.

Midnight means 12 o'clock in the night.

On the clock face we find Roman figures.



Key to clock face

1	one	I	7	seven	VII
2	two	II	8	eight	VIII
3	three	III	9	nine	IX
4	four	IIII	10	ten	X
5	five	V	11	eleven	XI
6	six	VI	12	twelve	XII

I = 1; V = 5; X = 10. I after V means V + I. I before X means X − I.

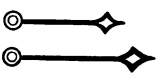
On the clock face we do not find any figures to tell us about the minutes.

60 minutes make 1 hour.
12 hours make 1 half day.
24 hours make 1 day.

Sign for morning hours, A.M.
Sign for afternoon and evening hours, P.M.

TELLING TIME

1 hour o'clock is the same place as 5 minutes. There are two hands on every clock, the hour hand and the minute hand.



The hour hand is always shorter than the minute hand.

When we studied the fives' table, we found that $5 \times 12 = 60$. There are 60 minutes in every hour, and 12 hours in every day.

The hour hand goes from XII to I in one hour, but the minute hand goes all the way around from XII past I, II, III, and so on to XII every hour. The minute hand goes twelve times as fast as the hour hand.

There are twelve numbers on the clock face to mark 60 minutes. Each number means in minutes just 5 times as much as it does in hours, on the clock.

I means in hours 1, but in minutes it means 5, $5 \times 1 = 5$.
II means in hours 2, but in minutes it means 10.
III means in hours 3, but in minutes it means 15.
IIII means in hours 4, but in minutes it means 20.
V means in hours 5, but in minutes it means 25.
VI means in hours 6, but in minutes it means 30.
VII means in hours 7, but in minutes it means 35.

When the minute hand points to more than 30, we usually read the number of minutes before the next hour.

6 o'clock and 35 minutes we usually call 25 minutes before 7. 60 minutes less 35 minutes are 25 minutes.

Railroads read this time 6 hours 35 minutes.

VIII means in hours 8, but in minutes it means 40.

6 hours 40 minutes are twenty minutes before 7 hours.

IX means in hours 9, but in minutes it means 45.
X means in hours 10, but in minutes it means 50.
XI means in hours 11, but in minutes it means 55.
XII means 12 hours, or 60 minutes, or 0 (no) minutes.

TELLING TIME

We say, "It is two o'clock." This means "It is two hours of the clock." When it is 2 o'clock, we find the minute hand at XII hours or 60 or 0 minutes.

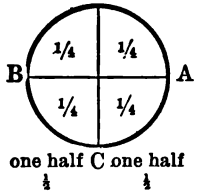
2 o'clock

10:20 o'clock
twenty minutes after ten

4:45 o'clock
quarter of five o'clock

7 o'clock

This circle is divided into quarters. When the minute hand reaches 15 minutes after XII or 60, we say it is quarter past whatever hour the hour hand is nearest. *A* is at III or 15 minutes. When the minute hand reaches 45 minutes after XII or 15 minutes ($60 - 45 = 15$) before XII, we say it is quarter before the hour the hour hand is nearest: that is, the hour toward which the hour hand is traveling. When the minute hand is at VI or 30 minutes, we say it is half past. $30 = 60 \div 2$. $30 = \frac{1}{2}$ of 60.



one half C one half
½ ½

1. Where should the hands be to show quarter past 9; quarter to 11; half past 9; quarter to 12; quarter past 10; half past 8; half past 3; half past 7; quarter to 12; quarter past 1; quarter past 6; half past 5?

2. Where is each hand at quarter past 12? at quarter past 2? at quarter to 3? at half past 4? at half past 6? at quarter to 9? at half past 11? at quarter to 8? at half past 3? at 10 minutes after 10?

TELLING TIME

1. Make a large clock face on thick paper or cardboard, or on the blackboard.

2. Draw the hands to show 5 minutes past 9 o'clock, 10 minutes past 10 o'clock, 15 minutes past 11 o'clock, 20 minutes past 12 o'clock, 25 minutes past 1 o'clock.

3. Draw the hands to show 25 minutes of 3 o'clock, 20 minutes of 4 o'clock, 15 minutes of 5 o'clock, 10 minutes of 6 o'clock, 5 minutes of 7 o'clock, and 8 o'clock.

4. Draw quarter past nine o'clock, half past ten o'clock, quarter of eleven o'clock, and six o'clock.

5. Draw each one of the hours one o'clock, two, three, four, five, six, seven, eight, nine, ten, eleven.

6. Make out of cardboard a clock face, and hands out of cardboard or wood, and set the time to suit your own ideas. Make all the different times o'clock in **2**, **3**, **4**, and **5** above.

7. Draw a picture of the clock in your schoolroom. What time does it tell? Perhaps it took you quite a long time to draw that picture. Draw another, telling what time it is now. How many minutes apart are the two times on the two clocks?

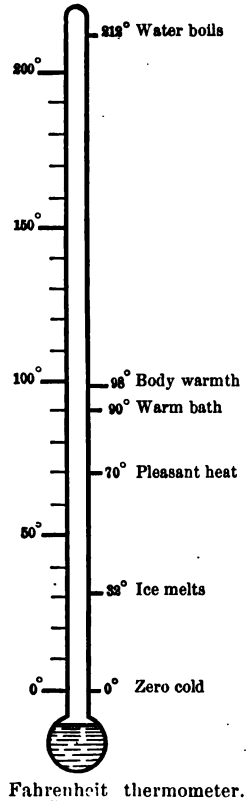
8. School begins at —— o'clock. Recess is at —— o'clock. Recess is over at —— o'clock. The morning session ends at —— o'clock. Draw four clock faces to show these times.

9. Do you have a daily program at school? When did this lesson begin? When will it end? Make clock faces to show these times. Show the times for other lessons.

10. Make clock faces showing the time when you get up in the morning, when you eat breakfast and other meals, and when you go to bed at night.

TELLING HEAT AND COLD

In the winter, when the fire goes out, we feel cold. In the summer we are often very warm. Sometimes in winter the fire is very hot, and our rooms are too warm. It is hot near bonfires or the fire in the blacksmith's shop. It is warmer in the sunshine than in the shade. We call the warmth or coldness of the air, the *temperature*.



Fahrenheit thermometer. The spaces are called *degrees*. This means equal parts of space. The sign for degree is °.

We have thermometers to tell us how warm or how cold it is. Thermometer is from *thermo*, heat, and *meter*, measure. Inside the glass of the thermometer is a liquid heavier than water. This is a metal called quicksilver or mercury. It looks like silver, but it flows quickly. Did you ever see little balls of quicksilver run across a table? This quicksilver needs more room and goes up the tube of the glass, when it is warm, but gets smaller and goes down in the glass when it is cold. If the glass is put in water with broken ice in it, the quicksilver goes to 32°. If we hold the bulb or thick end tight in one hand, the quicksilver goes nearly to 98°. In boiling water the quicksilver marks 212°. Hot weather is when the air is as warm as our bodies, 98°.

We like to have the air in our rooms at 70°; but in winter, to make the air pleasant at that temperature or warmth, we must have water vapor in it. That is why we put water on our stoves or in our furnaces, or let steam out of the steampipes into our rooms.

Cold air has only a little water vapor in it. When we warm the cold air, it needs more moisture to make it pleasant to breathe.

TELLING HEAT AND COLD

1. How many degrees do you find between melting ice and body warmth? $98° - 32° =$

2. How many degrees do you find between melting ice and the warm bath? $90° - 32° =$

3. Would you like to go swimming in a river full of floating blocks of ice? Why not?

4. Do you like to drink ice water when warm? Why?

5. We like to go swimming in salt sea water at 68°. How many degrees is that colder than our bodies?

6. In lakes there are often springs of cold water at 45°. Swimmers often have chills called "cramps" in fresh water because of these springs. Why? $98° - 45° =$

7. Cool water, 55°, is very pleasant and good to drink in summer when our bodies become very warm in the hot air. How much cooler is the water than our bodies if our temperature is 99°?

8. When we are sick, we usually have fever. Over 100° may be a fever. If our body warmth is 104°, our doctor is very anxious. How many degrees too warm is this? $104° - 98° =$

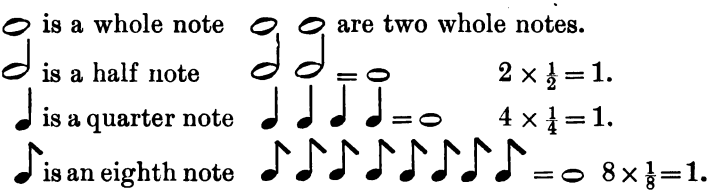
9. Sometimes we have a chill. If our body warmth falls three degrees, 3°, how warm are we? $98° - 3° =$

10. The temperature inside the mouth is 98° or 99°; that of ice cream is usually 32°. Why does it seem so cold?

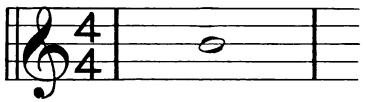
11. We warm the air with our body warmth. When the wind blows, it takes the warm air away from the skin fast. This is why we get just as cold in a strong wind when the air is 50° as we do on a quiet day when it is 32°. Compare $98° - 50° =$ and $98° - 32° =$

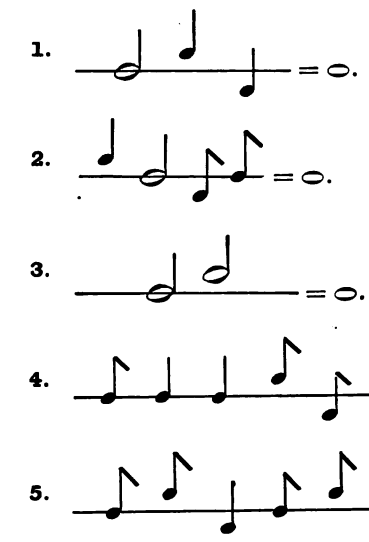
MUSIC FRACTIONS

In music we have equal parts or fractions of time. A whole note is the musical unit of time.



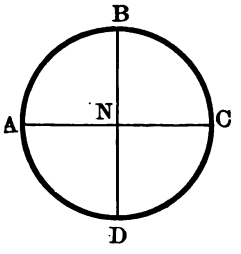
The space between the two vertical bars in this drawing is one measure. One whole note would take all the time in this measure. Two half notes would take all the time. Two quarter notes and one half note would also take all the time.



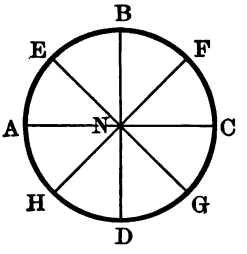


1. $\frac{1}{2} + \frac{1}{4} + \frac{1}{4} = 1.$
2. $\frac{1}{4} + \frac{1}{2} + \frac{1}{8} + \frac{1}{8} = 1.$
3. $\frac{1}{2} + \frac{1}{2} = 1.$
4. $\frac{1}{8} + \frac{1}{4} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 1.$
5. $\frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 1.$

TELLING ANGLES



A circle with 4 quarters and 4 right angles



A circle with 8 eighths and many different angles

AC is a diameter. It divides the circle into halves, for it is a straight line through the center of the circle.

BD is a diameter. It divides each of the circle's halves into two equal parts: $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$.

These are angles:

Acute Right Obtuse

Angles are formed by the meetings of lines. *ANB* is an angle. Trace it.

Two diameters crossing each other so as to divide a circle into quarters make right angles with each other.

We say that *BN* is perpendicular to *AN* because it forms the right angle *ANB*.

We call angles smaller than right angles *acute* angles. *ANE* is an acute angle. Point out other acute angles.

We call angles larger than right angles *obtuse* angles. *ANF* is an obtuse angle. Point it out.

We call this a *horizontal* line: ———.

And this we call a *vertical* line: |.

ABCD is the *perimeter* or *circumference* of the circle.

QUESTIONS

1. What is the ratio of 5 to 50? of 5 to 5? of 5 to 25? of 5 to 40? of 5 to 55? of 15 to 5? of 35 to 5? of 45 to 5? of 10 to 5? of 20 to 5?

2. What part of 30 is 5? 6? 12? 18? 24?

3. A mason can build a wall in 30 days. What part of it can he build in 5 days? in 6 days? in 18 days? in 12 days? in 24 days?

4. George can ride 50 miles in 5 hours on his wheel. What part of that distance can he ride in 1 hour? in 3 hours? in 4 hours?

5. How many feet are there in 25 inches? in 30 inches? in 60 inches?

6. Esther bought 9 yards of braid at 5¢ a yard. She gave the clerk a fifty-cent piece. What change should she get?

7. How much money will 5 gallons of kerosene cost at 12¢ a gallon?

8. Walter paid 40¢ for 2 quarts of molasses. How much would a pint cost at the same rate?

9. At 11¢ a quart, how many quarts of berries can you buy for 55¢?

10. Mr. Brown wishes to divide 40¢ equally among his four children. How many cents must he give to each child?

11. In a pond there were 36 lilies. A boy picked 9 of them. What part of the whole number of lilies did he pick?

12. A florist had 44 roses. $\frac{1}{11}$ of them were white, $\frac{2}{11}$ were red, and the rest were yellow. How many roses were white? How many were red? How many were yellow?

REVIEW

1. With a thermometer take the temperature out of doors at 8.30 A.M., at 12 M., and at 3 P.M. Tell the differences. Do this for five school days.

2. Take the temperature in the schoolroom every hour all day.

3. Draw pictures of thermometers, showing the quicksilver at 98°, at 32°, at zero, at 212°, at 70°, at 90°, at 100°.

4. Draw pictures of thermometers, telling when ice melts, when water boils, when the heat is pleasant, how warm the body is when one is well, when one has a fever, when one has a chill, how warm a bath should be, and how low the mercury is when it is very, very cold, below zero.

5. Why are some music notes called whole notes? half notes? quarter notes? eighth notes?

6. What time is it at noon? When does 12 o'clock come next?

7. How many hours do we spend in school each day?

8. Where are the hands on the clock face at the times when you go to school morning and afternoon?

9. Edgar raised 48 quarts of strawberries. He sold $\frac{1}{12}$ of them early in the season and $\frac{5}{12}$ of them later on. How many quarts did he sell at his first sale? How many quarts are $\frac{5}{12}$ of 48 quarts? $\frac{6}{12}$ of 48 quarts? $\frac{1}{2}$ of 48 quarts?

10. A bin contains 32 bushels of corn. The owner took out $\frac{1}{4}$ to be ground into meal and $\frac{1}{4}$ for food for his horses. How many bushels in all did he take out?

11. Which is the largest angle, an acute, a right, or an obtuse angle?

REVIEWS OF NUMBER TABLES

Counting by 3's.

1	2	**3**	4	5	**6**	7	8	**9**	10
11	**12**	13	14	**15**	16	17	**18**	19	20
21	22	23	**24**	25	26	**27**	28	29	**30**
31	32	**33**	34	35	**36**	37	38	**39**	40
41	**42**	43	44	**45**	46	47	**48**	49	50
51	52	53	**54**	55	56	**57**	58	59	**60**
61	62	**63**	64	65	**66**	67	68	**69**	70
71	**72**	73	74	**75**	76	77	**78**	79	80
81	82	83	**84**	85	86	**87**	88	89	**90**
91	92	**93**	94	95	**96**	97	98	**99**	100

Counting by 6's.

1	2	3	4	5	**6**	7	8	9	10
11	**12**	13	14	15	16	17	**18**	19	20
21	22	23	**24**	25	26	27	28	29	**30**
31	32	33	34	35	**36**	37	38	39	40
41	**42**	43	44	45	46	47	**48**	49	50
51	52	53	**54**	55	56	57	58	59	**60**
61	62	63	64	65	**66**	67	68	69	70
71	**72**	73	74	75	76	77	**78**	79	80
81	82	83	**84**	85	86	87	88	89	**90**
91	92	93	94	95	**96**	97	98	99	100

Counting by 4's.

1	2	3	**4**	5	6	7	**8**	9	10
11	**12**	13	14	15	**16**	17	18	19	**20**
21	22	23	**24**	25	26	27	**28**	29	30
31	**32**	33	34	35	**36**	37	38	39	**40**
41	42	43	**44**	45	46	47	**48**	49	50
51	**52**	53	54	55	**56**	57	58	59	**60**
61	62	63	**64**	65	66	67	**68**	69	70
71	**72**	73	74	75	**76**	77	78	79	**80**
81	82	83	**84**	85	86	87	**88**	89	90
91	**92**	93	94	95	**96**	97	98	99	**100**

Counting by 7's.

1	2	3	4	5	6	**7**	8	9	10
11	12	13	**14**	15	16	17	18	19	20
21	22	23	24	25	26	27	**28**	29	30
31	32	33	34	**35**	36	37	38	39	40
41	**42**	43	44	45	46	47	48	**49**	50
51	52	53	54	55	**56**	57	58	59	60
61	62	**63**	64	65	66	67	68	69	**70**
71	72	73	74	75	76	**77**	78	79	80
81	82	83	**84**	85	86	87	88	89	90
91	92	93	94	95	96	97	**98**	99	100

Counting by 5's.

1	2	3	4	**5**	6	7	8	9	**10**
11	12	13	14	**15**	16	17	18	19	**20**
21	22	23	24	**25**	26	27	28	29	**30**
31	32	33	34	**35**	36	37	38	39	**40**
41	42	43	44	**45**	46	47	48	49	**50**
51	52	53	54	**55**	56	57	58	59	**60**
61	62	63	64	**65**	66	67	68	69	**70**
71	72	73	74	**75**	76	77	78	79	**80**
81	82	83	84	**85**	86	87	88	89	**90**
91	92	93	94	**95**	96	97	98	99	**100**

Counting by 8's.

1	2	3	4	5	6	7	**8**	9	10
11	12	13	14	15	**16**	17	18	19	20
21	22	23	**24**	25	26	27	28	29	30
31	**32**	33	34	35	36	37	38	39	**40**
41	42	43	44	45	46	47	**48**	49	50
51	52	53	54	55	**56**	57	58	59	60
61	62	63	**64**	65	66	67	68	69	70
71	**72**	73	74	75	76	77	78	79	**80**
81	82	83	84	85	86	87	**88**	89	90
91	92	93	94	95	**96**	97	98	99	100

The 10's are always at the ends of the rows.

NUMBER TABLES 1 TO 144

Counting by 9's.

1	2	3	4	5	6	7	8	**9**	10	11	12
13	14	15	16	17	**18**	19	20	21	22	23	24
25	26	**27**	28	29	30	31	32	33	34	35	**36**
37	38	39	40	41	42	43	44	**45**	46	47	48
49	50	51	52	53	**54**	55	56	57	58	59	60
61	62	**63**	64	65	66	67	68	69	70	71	**72**
73	74	75	76	77	78	79	80	**81**	82	83	84
85	86	87	88	89	**90**	91	92	93	94	95	96
97	98	**99**	100	101	102	103	104	105	106	107	**108**
109	110	111	112	113	114	115	116	**117**	118	119	120
121	122	123	124	125	**126**	127	128	129	130	131	132
133	134	**135**	136	137	138	139	140	141	142	143	**144**

Notice that the 2 figures in each number which contains 9 always add together 9, except 99. $9 + 9 = 18$, $1 + 8 = 9$. Notice also that the unit figure of each larger multiple of 9 is always 1 less: 18, 27, 36, and so on.

Counting by 11's.

1	2	3	4	5	6	7	8	9	10	**11**	12
13	14	15	16	17	18	19	20	21	**22**	23	24
25	26	27	28	29	30	31	32	**33**	34	35	36
37	38	39	40	41	42	43	**44**	45	46	47	48
49	50	51	52	53	54	**55**	56	57	58	59	60
61	62	63	64	65	**66**	67	68	69	70	71	72
73	74	75	76	**77**	78	79	80	81	82	83	84
85	86	87	**88**	89	90	91	92	93	94	95	96
97	98	**99**	100	101	102	103	104	105	106	107	108
109	**110**	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	**132**
133	134	135	136	137	138	139	140	141	142	**143**	144

Notice that from 1 to 100 the 2 figures in each multiple of 11 are always the same, and that above 100 the number of tens always increases 1, 110, 121, and so on, and the number of units always increases 1, 121, 132, 143.

1. Copy these Number Tables in red and blue pencil on paper, or in red and blue chalk on the blackboard.

2. Read these Tables in class, explaining them.

ORAL

1. Count by fours to one hundred.
2. How many are $15-4+8+9+3-10-2-7\times 2=?$
3. How many dimes are there in half a dollar?
4. How much is $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{3}$ of $\frac{1}{3}$? $\frac{1}{5}$ of $\frac{1}{2}$?
5. Is $\frac{1}{3}$ more or less than $\frac{1}{2}$? $\frac{1}{6}$ than $\frac{1}{9}$? $\frac{1}{5}$ than $\frac{1}{3}$? Why?
6. Give the multiplication table of threes.
7. How many pints are there in a gallon? in a peck?
8. Measure the size of the schoolroom in feet.
9. Read the calendar for to-day.
10. Tell a number-story about 24 cents, 4 boys, and two dozen apples that cost a dime a dozen.

WRITTEN

1. Add:

15	31	44
7	10	16
12	9	8

2. Subtract:

46	92	74
17	14	65

3. Write the Number Table of One Hundred, showing very plainly every number containing 7.
4. Draw a clock face, showing 5.20 o'clock.
5. Draw a rectangle divided into sixths.
6. Write in words 2671, 4203, 3031, 1850.
7. Answer $5+(4\times 2)=?$ $(3\times 3)+9=?$ $(18\div 6)+7=?$
8. John had one dollar. He spent a quarter for a cap, forty cents for a bantam hen, and a nickel for chestnuts. How much money did he have left?
9. What is the ratio of 6 to 9? of 12 to 4? of $\frac{1}{2}$ to $\frac{1}{8}$?
10. Write the address of your house and the day of the month and week.

READING PROBLEMS

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
1.	123	142	156	116	111	121	133	145	134	144
	16	12	13	22	27	18	15	14	24	14

We may read **1** *a*. Add 123 and 16.

	k	*l*	*m*	*n*	*o*	*p*	*q*	*r*	*s*	*t*
2.	118	124	136	128	137	148	125	132	149	150
	−14	−12	−15	−23	−14	−37	−24	−11	−39	−100

The sign − means that the number after it is to be taken from the number before it. We may read **2** *k*. — From 118 take, or subtract, 14.

Read the other problems in **2**, using the word "subtract."

	1	2	3	4	5	6	7	8	9	10
3.	21	34	42	50	111	93	61	222	1000	2000
	×4	×2	×5	×5	×3	×2	×5	×4	×5	×3

The sign × means that the number before it is to be multiplied by the number after it. We may read **3** 1. — 21 multiplied by 4 are how many? Or, — Multiply 21 by 4.

Read the other problems in **3**, using the word "multiply."

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
4.	5)55	6)64	3)21	7)70	6)48	9)27	7)28	8)32

4 *A*. Divide 55 by 5. Read the other problems.

	I	*J*	*K*	*L*	*M*	*N*	*O*
5.	4)128	3)164	5)155	4)164	3)99	5)500	7)728

6. 23 × 3 = ? 23 taken 3 times are how many? Or, 23 multiplied by 3 are how many? Or, 3 times 23 is how much?

Read: 25 × 4 = ? 50 × 2 = ? 100 × 3 = ? 33 × 3 = ?

7. 44 ÷ 2 = ? Read: 44 divided by 2 are how many?

Read: 66 ÷ 3 = ? 36 ÷ 4 = ? 48 ÷ 4 = ? 100 ÷ 10 = ?

SUBTRACTION

Subtraction finds the difference between two numbers.

The **minuend** is the number from which another number is taken or subtracted.

The **subtrahend** is the number to be taken or subtracted from the minuend.

The result of subtraction is the **difference** or **remainder**.

From 35 subtract 14.

35	5 less 4 = 1	35	minuend
14	30 less 10 = 20	14	subtrahend
		21	remainder

Proof. Add the remainder to the subtrahend, and if the sum equals the minuend, the work is correct.

14
21
35

Only numbers of like things can be subtracted.

Subtract:

1. from 78: 18, 17, 16, 15, 14, 13, 12, 11; 21, 22, 23, 24, 25, 26, 27, 28; 31, 42, 53, 64, 75.

2. from 99 the same numbers as in **1**.

3. from 57: 46, 35, 24, 13; 14, 25, 36, 47; 45, 33, 22, 11.

4. from 69 the same numbers as in **3**.

5. John's father gave him 84 tin soldiers. He gave away 2 dozen of them to his schoolmates, and later lost a half dozen. After his gifts to the other boys, how many soldiers had John left? After his loss, how many had he left?

6. Mary made dolls out of 66 clothes-pins. 25 of the dolls were very nice dolls. How many dolls were there that she did not like very well?

7. Make up questions like **5** and **6**, using the numbers in **1**, **2**, **3**, and **4**. Answer these orally.

ADDITION AND SUBTRACTION

Add 51 and 17.

$$\begin{array}{r} 51 \\ 17 \\ \hline 68 \end{array}$$

The sum of the units, 7 and 1, is 8 units. We write 8 in units' column.

The sum of the tens is 6 tens. We write 6 in tens' column.

Add:

1.	7	14	26	92	22	14	70	33	58	62	20	25
	8	11	13	17	46	53	28	45	31	27	40	51
2.	2	11	12	11	71	54	43	25	10	41	41	22
	61	27	41	14	16	22	21	12	31	21	2	21
	35	60	33	42	10	11	35	51	47	2	21	41

3.	10	2	12	30	41	14	2	13	21	71	30	2	3
	7	4	44	16	3	11	12	14	20	3	13	14	2
	6	1	11	11	2	21	44	21	23	2	11	10	4
	2	2	12	21	20	32	1	31	24	20	12	61	10

Subtract 15 from 77.

$$\begin{array}{r} 77 \\ 15 \\ \hline 62 \end{array}$$

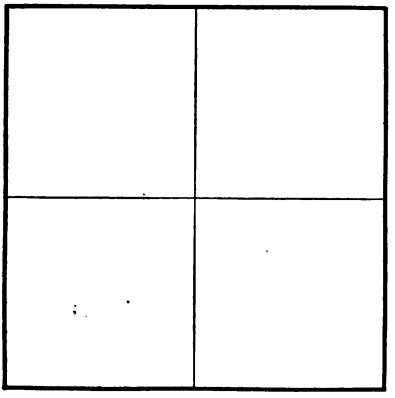
$7 - 5 = 2$. We write 2 in units' place. 7 tens less 1 ten are 6 tens. We write 6 in tens' place.

Subtract:

4.	12	21	45	79	87	72	45	54	66	31	77	97
	11	11	23	18	16	41	14	23	33	30	45	82
5.	38	29	14	73	88	81	25	19	20	46	79	87
	15	18	14	53	17	41	5	9	10	45	19	15

SQUARE MEASURE

How long is each side of this figure? How many squares do you see here? How many square inches are there?



If we multiply together the lengths in inches, or feet, or yards, or miles, of each of two sides of a square, we get the size of the square in square inches or square feet or square yards or square miles.

2 sq. in. × 2 = 4 square inches = 4 sq. in.

The size of the surface of any figure is told by square measure. The surface of any figure or object which is level or flat, or "plane," as it is often called, has always length and breadth. The surface size is called **area.**

1. Show by a drawing that the area of a square with sides 3 inches in length is 9 square inches.

2. Show by a drawing that the area of an oblong with length of 5 inches and breadth of 3 inches is 15 square inches.

3. Find the area of an oblong 4 feet × 6 feet.

4. Find the area of an oblong 10 yards × 12 yards.

5. Find the area of a township 4 miles × 5 miles.

6. Tell the area of a picture 10 inches × 14 inches.

ONE-HALF AND TWO

1. $\frac{1}{2}$ of 6 = ? $\frac{1}{2}$ of 18 = ? $\frac{1}{2}$ of 12 = ? $\frac{1}{2}$ of 2 = ?
$\frac{1}{2}$ of 20 = ? $\frac{1}{2}$ of 10 = ? $\frac{1}{2}$ of 8 = ? $\frac{1}{2}$ of 14 = ?

2. How many 2's are there in 6? Or, 6 contains how many 2's? Or, 6 divided by 2 is how much? What is the ratio of 2 to 6? of 6 to 2?

3. $2\overline{)16}$ $2\overline{)8}$ $2\overline{)12}$ $2\overline{)14}$ $2\overline{)10}$ $2\overline{)18}$ $2\overline{)20}$ $2\overline{)4}$

4. How many 2's are there in 11? Five 2's and 1 over; that is, 11 contains five 2's and one 1.

$$(5 \times 2) + 1 = ? \qquad 2\overline{)11}\ 5 + 1$$

5. 5 + 2 = ? 3 + 2 = ? 7 + 2 = ? 9 + 2 = ?
15 + 2 = ? 17 + 2 = ? 19 + 2 = ? 13 + 2 = ?

6. $2\overline{)9}$ $2\overline{)13}$ $2\overline{)17}$ $2\overline{)19}$ $2\overline{)15}$ $2\overline{)7}$ $2\overline{)11}$ $2\overline{)3}$

MULTIPLYING A FRACTION

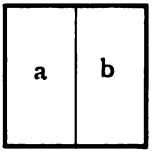
7. If a is $\frac{1}{2}$ of S, and if $b = \frac{1}{2}$ of S,

then $a + b = 2 \times \frac{1}{2}$ of S.

But $a + b = S$.

Then $S = 2 \times \frac{1}{2} = \frac{2}{2} = 1$.

Two halves make one whole.



S

SQUARE

MULTIPLYING A WHOLE NUMBER AND FRACTION

8. $2 \times 1\frac{1}{2} = ?$ $2 \times 1 = 2$ $2 \times \frac{1}{2} = 1$ $2 \times 1\frac{1}{2} = 2 + 1 = 3$.

9. $2 \times 2\frac{1}{2} = ?$ $2 \times 3\frac{1}{2} = ?$ $2 \times 4\frac{1}{2} = ?$ $2 + 5\frac{1}{2} = ?$

10. John had seven apples. He gave one half of them to his sister. How many apples did she receive?

PARTS

Cut out of paper a square one inch on each side.

Then cut out a rectangle two inches long, one inch high.

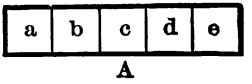
The square is one half as large as the rectangle.

Cut the square into two equal parts, one inch by $\frac{1}{2}$ inch.

Cut the rectangle into four equal parts.

Do you see that the 2 parts of the square are $\frac{2}{4}$ of the rectangle?

There are 5 equal parts in A. Each is $\frac{1}{5}$ of A.



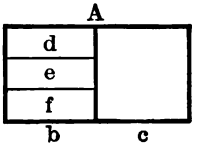
$a + b = 2$ fractions of $A = \frac{2}{5}$ of A.

$a + b + c = 3$ fractions of $A = \frac{3}{5}$ of A.

$a + b + c + d = 4$ fractions of $A = \frac{4}{5}$ of A.

$a + b + c + d + e = 5$ fractions of $A = \frac{5}{5}$ of A.

But as there are only 5 parts in A, $\frac{5}{5}$ of A = all of A = 1 A.



This form-picture is divided into two parts, $b + c$. $b = \frac{1}{2}$ of A. $c = \frac{1}{2}$ of A.

The picture of b is divided into three parts, d, e, f. $d = \frac{1}{3}$ of b. $e = \frac{1}{3}$ of b. $f = \frac{1}{3}$ of b.

If we divide c into three parts, then A will have 6 parts.

If A has 6 parts, then $d = \frac{1}{6}$ of A.

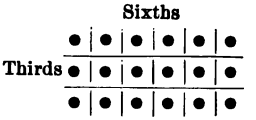
$d = \frac{1}{3}$ of $\frac{1}{2}$ of A, because d is $\frac{1}{3}$ of b, which is $\frac{1}{2}$ of A.

1. $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} = ?$
2. $\frac{1}{6} + \frac{1}{6} + \frac{2}{6} + \frac{2}{6} = ?$
3. $\frac{1}{3} + \frac{1}{6} = ?$
4. $\frac{1}{5} + \frac{2}{5} + \frac{2}{5} = ?$
5. $\frac{1}{2} + \frac{1}{2} = ?$
6. $\frac{1}{3} - \frac{1}{6} = ?$

Cut and fold pieces of paper to show the answers to these six questions.

RATIOS, 3, $\frac{1}{3}$, 4, $\frac{1}{4}$, 5, $\frac{1}{5}$

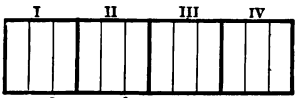
1. How many 3's are there in 18? $\frac{1}{3}$ of 18 = ?
   How many 6's are there in 18? $\frac{1}{6}$ of 18 = ?
   What is the ratio of 3 to 18? of 18 to 3?



2. How many 3's are there in 15?
   How many 4's are there in 12? $\frac{1}{3}$ of 12 = ? $\frac{1}{4}$ of 12 = ?
   What is the ratio of 3 to 12? of 12 to 3? of 12 to 4? of 4 to 12?

3. How many 5's are there in 15? $\frac{1}{3}$ of 15 = ? $\frac{1}{5}$ of 15 = ?
   What is the ratio of 5 to 15? of 15 to 5? of 3 to 15? of 15 to 3?
   How many 3's are there in 12? What is the ratio of 4 to 12? of 12 to 4?

4. When we ask, What is the ratio of 3 to 12? we mean, What part of 12 is 3.



O OBLONG

$3 \times ? = 12$. $\frac{1}{4}$ of 12 = ?

Into how many parts is the oblong divided?

What part of *O* is 1? How many times IV is *O*?

5. When we ask, What is the ratio of 12 to 3? we mean, How many times does 12 contain 3?
   Ratio compares one thing with another.
   Ratio measures one thing by another.
   When anything is divided into equal parts, we may call the parts **fractions.**

6. There were 80 marbles to divide among 10 boys equally. What is the ratio of 80 to 10?

MULTIPLYING WHOLE NUMBERS AND FRACTIONS

1. A newsboy bought 10 papers at $1\frac{1}{2}¢$ each, and sold them at $2¢$ each. How many cents did he make or lose?

$1\frac{1}{2}¢ = \frac{2}{2}¢ + \frac{1}{2}¢ = \frac{3}{2}¢$. $10 \times \frac{3}{2}¢ = \frac{30}{2}¢ = 15¢$.

$10 \times 2¢ = 20¢$. $20¢ - 15¢ = 5¢$.

Or, $2¢ - 1\frac{1}{2}¢ = \frac{1}{2}¢$. $\frac{1}{2}¢ \times 10 = \frac{10}{2}¢$.

$\frac{10}{2}¢ = 5¢$.

2. One boy one day was just twice as old as his brother, who was four and a quarter years old. How old was the older brother? $4\frac{1}{4}$ yr. $\times 2 = ?$ yr.

$4\frac{1}{4}$ yr. $= \frac{16}{4}$ yr. $+ \frac{1}{4}$ yr. $= \frac{17}{4}$ yr. $2 \times \frac{17}{4}$ yr. $= \frac{34}{4}$ yr. $\frac{34}{4}$ yr. $= 8\frac{2}{4}$ yr. $= 8\frac{1}{2}$ yr.

3. Each pupil in a class had $2\frac{1}{3}$ sheets of paper. There were 11 pupils in the class. How many sheets had all the pupils? $11 \times 2\frac{1}{3}$ sheets $= ?$

$2\frac{1}{3}$ sheets $= \frac{6}{3}$ sheets $+ \frac{1}{3}$ sheet $= \frac{7}{3}$ sheets. $11 \times \frac{7}{3}$ sheets $= \frac{77}{3}$ sheets. $\frac{77}{3}$ sheets $= 25\frac{2}{3}$ sheets.

4. There is still another way to get the answer for 1. Suppose we ask, $10 \times 1\frac{1}{2} = ?$ $1\frac{1}{2} = \frac{3}{2}$.

Then $10 \times \frac{3}{2} = \frac{10}{2} \times 3$ or $5 \times 3 = 15$.

We can do this whenever the fraction divides the multiplier exactly.

5. Make questions, asking $4 \times 3\frac{1}{5} = ?$ $6 \times 3\frac{2}{3} = ?$ $2 \times 1\frac{3}{5} = ?$ $3 \times 2\frac{3}{4} = ?$

6. $6\frac{1}{10}¢ \times 5 = ?¢$. $3\frac{1}{2}$ yd. $\times 8 = ?$ yd. $4\frac{1}{6}$ yr. $\times 4 = ?$ yr. $\$2\frac{1}{5} \times 10 = \$?$ $\$3\frac{2}{5} \times 5 = \$?$

GENERAL REVIEW

1. Add $4 + 17 + (3 \times 3) + 6 + 7 + 3 - 7$.

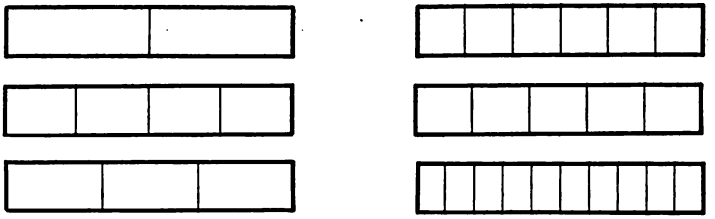
2. Answer, $20 - 4 + 10 - (4 \times 2) + (12 + 3) + 18 = ?$

3. Tell what are the *minuend*, the *subtrahend*, and the *difference* or *remainder* in subtraction.

4. What are the meanings of A.M. and of P.M. in telling time?

5. Give some of the multiplication tables you know.

6. Tell ratio and fraction facts about these:



7. What do we mean by *ratio?* by *fraction?*

COPY AND ANSWER WRITE

1.

23	32	43	50	333	2000	123	400	99	99
×4	×3	×6	×8	×3	×4	×5	×10	×5	×7

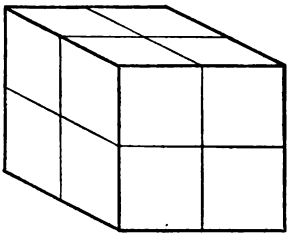
2. Add 63, 95, 18, 100, 74. 3. Add 1544, 10, 987, 1009.

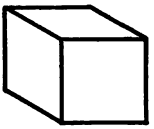
4. Subtract from 89: 19, 27, 32, 76, 54, 49, 11, 55, 68.

5. Draw clock faces to show: a quarter after eight o'clock; 10.25; and ten minutes of four o'clock.

6. A room was 4 yd. by $4\frac{1}{4}$ yd. in size. What was its area?

CUBIC MEASURE





Each of these blocks has square sides and right angles. Each block is called a **cube**.

How many small cubes do you find in the large cube? If we multiply together the lengths in inches or feet or yards of each side of a cube, we get its size in cubic inches or cubic feet or cubic yards. The size in cubic measure of any object is often called its **volume**. If each side of a cube is 2 inches long, then its volume is 8 cubic inches. 2 in. × 2 in. × 2 in. = 2 × 2 × 2 cu. in. = 8 cu. in.

1. What is the volume of a cube each side of which is 3 inches long?

2. What is the volume of a cube 2 in. × 3 in. × 4 in.?

3. What is the volume of a cube 1 ft. × 2 ft. × 4 ft.?

4. Measure the sizes in inches of boxes.

REVIEW QUESTIONS

5. The difference between two numbers is 7, and the smaller number is 6. What is the larger number?

6. How many 9's are there in 18? How many 2's? 9 is what part of 18?

7. What is the ratio of 2 to 16? of 4 to 16? of 16 to 2? of 16 to 4?

HALVES AND FOURTHS

1. Emma's mother cut a pie into halves. Then she cut each half into 2 equal parts. What part of the whole pie should we call each of those parts?

2. If Emma got $\frac{1}{4}$ of the pie, how many fourths were left?

3. I bought a cake and ate $\frac{3}{4}$ of it. How much of the cake was left?

4. Fred had a large orange. He cut it into halves. Then he cut each half into 2 equal parts. In how many pieces was the orange then?

5. 4)17 4)19 4)21 4)29 4)34 4)39 4)43 4)47

6. How many 4's are there in 24? 36? 12? 16? 20? 40? 46? 44? 8? 28? 32?

7. $\frac{1}{4}$ of 28 = ? $\frac{2}{4}$ of 28 = ? $\frac{3}{4}$ of 28 = ? $\frac{1}{2}$ of 28 = ?

8. $\frac{1}{4}$ of 36 = ? $\frac{2}{4}$ of 36 = ? $\frac{3}{4}$ of 36 = ? $\frac{1}{2}$ of 36 = ?

9. $\frac{1}{4}$ of 8 = ? $\frac{2}{4}$ of 8 = ? $\frac{3}{4}$ of 8 = ? $\frac{1}{2}$ of 8 = ?

10. $\frac{1}{4}$ of 20 = ? $\frac{2}{4}$ of 20 = ? $\frac{1}{2}$ of 20 = ? $\frac{3}{4}$ of 20 = ?

11. $\frac{1}{4}$ of 32 = ? $\frac{3}{4}$ of 32 = ? $\frac{1}{2}$ of 32 = ? $\frac{2}{4}$ of 32 = ?

12. $\frac{1}{4}$ of 48 = ? $\frac{2}{4}$ of 48 = ? $\frac{1}{2}$ of 48 = ? $\frac{3}{4}$ of 48 = ?

13. $\frac{1}{4}$ of 40 = ? $\frac{3}{4}$ of 40 = ? $\frac{2}{4}$ of 40 = ? $\frac{1}{2}$ of 40 = ?

14. $\frac{1}{4}$ of 16 = ? $\frac{2}{4}$ of 16 = ? $\frac{3}{4}$ of 16 = ? $\frac{1}{2}$ of 16 = ?

15. $\frac{1}{4}$ of 24 = ? $\frac{2}{4}$ of 24 = ? $\frac{1}{2}$ of 24 = ? $\frac{3}{4}$ of 24 = ?

16. $\frac{1}{4}$ of 44 = ? $\frac{3}{4}$ of 44 = ? $\frac{2}{4}$ of 44 = ? $\frac{1}{2}$ of 44 = ?

17. $\frac{1}{4}$ of 12 = ? $\frac{1}{2}$ of 12 = ? $\frac{2}{4}$ of 12 = ? $\frac{3}{4}$ of 12 = ?

SIX AND SIXTHS

1. 6)25 6)31 6)38 6)74 6)63 6)51
   6)14 6)44 6)57 6)38 6)19 6)68

2. $\frac{1}{6}$ of 24 = ? $\frac{2}{6}$ of 24 = ? $\frac{3}{6}$ of 24 = ? $\frac{4}{6}$ of 24 = ?
   $\frac{5}{6}$ of 24 = ? $\frac{1}{4}$ of 24 = ? $\frac{2}{4}$ of 24 = ? $\frac{1}{2}$ of 24 = ?
   $\frac{2}{4}$ = what other fraction?

Copy and answer:

3. 60 ÷ 20 = ? 80 ÷ 40 = ? 3 × 20 = ? 50 ÷ 50 = ?
4. 80 ÷ 20 = ? 90 ÷ 30 = ? 20 × ? = 80 60 ÷ 30 = ?
5. 70 ÷ 10 = ? 100 ÷ 50 = ? 10 × ? = 70 100 ÷ 10 = ?
6. 100 − 50 = ? 100 − 30 = ? 100 − 80 = ? 100 − 60 = ?
7. 100 ÷ 5 = ? 40 ÷ 4 = ? 100 ÷ 10 = ? 80 ÷ 2 = ?
8. 70 ÷ 7 = ? 80 ÷ 4 = ? 40 ÷ 2 = ? 100 ÷ 2 = ?
9. 80 ÷ 8 = ? 50 ÷ 5 = ? 60 ÷ 2 = ? 30 ÷ 3 = ?
10. 29 = (6 × 4) + ? 14 = (6 × 2) + ? 33 = (6 × 5) + ?
11. 20 = (6 × 3) + ? 75 = (6 × 12) + ? 40 = (6 × 6) + ?
12. 59 = (6 × 9) + ? 67 = (6 × 11) + ? 44 = (6 × 7) + ?
13. 51 = (6 × 8) + ? 65 = (6 × 10) + ? 9 = (6 × 1) + ?
14. (6 × 7) + 3 − 5 − 5 = ? (4 × 4) + 6 + 6 − 2 − 5 = ?
15. (9 × 6) + 6 − 10 − 3 + 1 = ? (5 × 9) + 10 + 4 + 5 − 6 = ?
16. (5 × 7) + 5 + 10 − 8 − 2 − 1 = ? (6 × 2) + 6 + 5 − 8 − 1 = ?
17. (6 × 5) + 10 + 10 + 5 − 3 − 4 = ? (6 × 4) + 6 + 5 + 10 − 8 = ?

18. Tom had some apples. He gave five to each of eleven boys and had four left for himself. How many had he in all at first?

19. (12 × 3) − (8 × 4) + 8 = ? 5 + 8 − 6 + 3 = ?

FRACTIONS AND RATIOS

1. Count by 3's from 21 to 36.

2. $3+3+3+3+3+3+3=?$ Seven 3's $=?$ $3\times7=?$ $7\times3=?$

3. Add 3 to 21. How many 3's are there in 24? What is $\frac{1}{8}$ of 24? $8\times3=?$ $3\times8=?$

4. Add 3 to 24. How many 3's are there in 27? $3\times9=?$ $9\times3=?$ $\frac{1}{9}$ of $27=?$ How many 9's are there in 27? $\frac{2}{9}$ of $27=?$ $\frac{1}{3}$ of $27=?$ $\frac{2}{3}$ of $27=?$

5. Add 3 to 27. How many 3's are there in 30? What is $\frac{1}{3}$ of 30? $\frac{2}{3}$ of $30=?$ How many 10's are there in 30? $\frac{1}{10}$ of $30=?$ $10\times3=?$ $3\times10=?$

6. $30+3=?$ How many 3's are there in 33? $3\times11=?$ $11\times3=?$ $\frac{1}{3}$ of $33=?$ $\frac{2}{3}$ of $33=?$ $\frac{1}{11}$ of $33=?$ $\frac{3}{11}$ of $33=?$ $\frac{7}{11}$ of $33=?$ $\frac{9}{11}$ of $33=?$ How many 11's are there in 33? $33+3=?$

7. Count by 3's from 3 to 36. How many 3's are there in 36? What is $\frac{1}{3}$ of 36? What is $\frac{1}{12}$ of 36? How many 12's are there in 36? $3\times12=?$ $12\times3=?$

8. $\frac{1}{3}$ of $36=?$ $\frac{1}{6}$ of $36=?$ $\frac{1}{12}$ of $36=?$ $\frac{1}{9}$ of $36=?$ $\frac{1}{4}$ of $36=?$

9. $\frac{1}{3}=\frac{?}{6}$. $\frac{1}{6}=\frac{?}{12}$. $\frac{1}{3}=\frac{?}{12}$. $\frac{1}{3}=\frac{?}{9}$.

10. What is the ratio to 36 of 3; 4; 6; 9; and 12?

11. What is the ratio of 36 to 3; 4; 6; 9; and 12?

12. What is the ratio of $\frac{1}{10}$ to $\frac{1}{5}$? of $\frac{1}{4}$ to $\frac{1}{12}$?

13. Take $\frac{1}{8}$ from $\frac{1}{4}$.

14. How much more is $\frac{1}{6}$ of 24 than $\frac{1}{8}$ of 24?

15. Find $\frac{3}{8}$ of 48.

TENS

I. What is the largest number that can be expressed by one figure?

II. What is the largest number that can be expressed by two figures?

III. In the number 100 is there any unit in units' place? Is there any ten in tens' place?

	A	*B*	*C*	*D*
1.	$40+10=?$	$90+10=?$	$50+10=?$	$70+10=?$
2.	$30+10=?$	$70+20=?$	$50+20=?$	$60+20=?$
3.	$30+30=?$	$20+30=?$	$20+10=?$	$20+20=?$
4.	$40+60=?$	$40+50=?$	$40+20=?$	$40+40=?$
5.	$60+40=?$	$60+30=?$	$50+40=?$	$50+50=?$
6.	$20+70=?$	$20+80=?$	$70=20+?$	$80+20=?$
7.	$40+60=?$	$30+70=?$	$60=30+?$	$50+40=?$

REVIEW QUESTIONS

8. How many times can 10 be taken from 30?

9. If 3 be taken three times from 15, what will be the remainder?

10. By how much does 20 exceed 11?

11. A boy had 13¢. He gave 4¢ to one boy and 5¢ to another. How many cents had he left?

12. How much must I add to 30 to make it 41?

13. After giving away 13 marbles, a boy had 21 left. How many had he at first?

14. What number must be taken from 17 to leave 11?

15. The sum of two numbers is 23, and the smaller number is 7. What is the larger number?

16. A boy had 23 apples. To how many boys could he give four apples each? and how many apples would he have left?

TENS

Copy and answer:

	A	*B*	*C*	*D*
1.	55 = 50 + ?	40 + ? = 50	70 + 9 = ?	30 + 1 = ?
2.	60 = 50 + ?	45 + ? = 55	70 + 10 = ?	30 + 5 = ?
3.	65 = 55 + ?	50 + ? = 60	90 + 1 = ?	30 + 8 = ?
4.	70 = 60 + ?	55 + ? = 60	90 + 3 = ?	30 + 9 = ?
5.	75 = 70 + ?	55 + ? = 65	90 + 5 = ?	30 + 10 = ?
6.	80 = 70 + ?	60 + ? = 70	90 + 8 = ?	50 + 3 = ?
7.	85 = 80 + ?	65 + ? = 75	90 + 9 = ?	50 + 5 = ?
8.	90 = 80 + ?	70 + ? = 75	40 + 2 = ?	50 + 6 = ?
9.	95 = 90 + ?	80 + ? = 85	40 + 4 = ?	50 + 7 = ?
10.	100 = 90 + ?	90 + ? = 100	40 + 7 = ?	50 + 10 = ?
11.	8 tens = ?	95 + ? = 100	40 + 8 = ?	70 + 5 = ?
12.	30 tens = ?	70 tens = ?	40 + 10 = ?	70 + 6 = ?
13.	10 tens = ?	7 tens = ?	60 + 4 = ?	70 + 8 = ?
14.	2 tens = ?	40 tens = ?	2 tens × 3 = ?	20 tens = ?

RECITE

15. Answer the questions by columns as well as by rows. Answer also without following any regular order.

16. How many different questions are there above on this page?

Answer:

	E	*F*	*G*	*H*
17.	50 − 30 = ?	40 − 10 = ?	70 − 20 = ?	100 − 40 = ?
18.	80 − 60 = ?	50 − 20 = ?	80 − 20 = ?	100 − 30 = ?
19.	90 − 80 = ?	70 − 30 = ?	60 − 40 = ?	50 − 50 = ?
20.	90 − 60 = ?	80 − 50 = ?	70 − 60 = ?	40 − 30 = ?

UNITS, TENS, HUNDREDS

How many units or ones does the figure 9 represent? 6? 8? 7? 4? 5?

Show these by such objects as splints, counters, pennies, dots, or crosses. The figure is not the number itself. It only represents the number of ones.

How many units do the figures 1 and 1 represent in 11? Each 1 does not represent the same number of units.

We read the letters in words from left to right, and we read the names of numbers also from left to right, as for example, 975, nine hundred seventy-five; but we tell the place and value of any figure by reading the figures themselves from right to left. In 11, beginning at the right, the first 1 means one unit, and the second 1 means ten units, or 1 ten.

The zeros in 10, in 20, in 30, show that there are no units in units' place, and that the 1, or 2, or 3 represents tens. Read 20, 30, 40, 50, 60, 70, 80, 90, and tell for what each figure stands.

1. In the number 19, which figure has greater value?

2. How many 1's or units are there in 18? in 12? in 13? in 17? in 14? in 16? in 15? in 19?

3. How many tens and how many units are there in 27? 36? 42? 68? 57? 79? 85? 93?

4. In 600, the first zero at the right shows that the number has no units, and the second zero shows that it has no tens. How many hundreds are there?

5. In 468, which figure has the greatest value? Which the least? Explain.

FIVES AND FIFTHS

1. $5 \div 5 = ?$ $10 \div 5 = ?$ $25 \div 5 = ?$ $35 \div 5 = ?$
   $45 \div 5 = ?$ $60 \div 5 = ?$ $50 \div 5 = ?$ $30 \div 5 = ?$
   $55 \div 5 = ?$ $20 \div 5 = ?$ $15 \div 5 = ?$ $40 \div 5 = ?$

2. $5\overline{)5}$ $5\overline{)10}$ $5\overline{)11}$ $5\overline{)12}$ $5\overline{)13}$ $5\overline{)14}$ $5\overline{)17}$
   $5\overline{)19}$ $5\overline{)20}$ $5\overline{)28}$ $5\overline{)30}$ $5\overline{)35}$ $5\overline{)39}$ $5\overline{)44}$
   $5\overline{)53}$ $5\overline{)47}$ $5\overline{)50}$ $5\overline{)54}$ $5\overline{)56}$ $5\overline{)59}$ $5\overline{)60}$

3. $\frac{1}{5}$ of $20 = ?$ $\frac{2}{5}$ of $20 = ?$ $\frac{3}{5}$ of $20 = ?$ $\frac{4}{5}$ of $20 = ?$
4. $\frac{1}{5}$ of $35 = ?$ $\frac{2}{5}$ of $35 = ?$ $\frac{3}{5}$ of $35 = ?$ $\frac{4}{5}$ of $35 = ?$
5. $\frac{1}{5}$ of $50 = ?$ $\frac{2}{5}$ of $50 = ?$ $\frac{3}{5}$ of $50 = ?$ $\frac{4}{5}$ of $50 = ?$
6. $\frac{1}{5}$ of $25 = ?$ $\frac{2}{5}$ of $25 = ?$ $\frac{3}{5}$ of $25 = ?$ $\frac{4}{5}$ of $25 = ?$
7. $\frac{1}{5}$ of $40 = ?$ $\frac{2}{5}$ of $40 = ?$ $\frac{4}{5}$ of $40 = ?$ $\frac{3}{5}$ of $40 = ?$
8. $\frac{1}{5}$ of $10 = ?$ $\frac{3}{5}$ of $10 = ?$ $\frac{4}{5}$ of $10 = ?$ $\frac{2}{5}$ of $10 = ?$
9. $\frac{1}{5}$ of $60 = ?$ $\frac{2}{5}$ of $60 = ?$ $\frac{3}{5}$ of $60 = ?$ $\frac{4}{5}$ of $60 = ?$
10. $\frac{1}{5}$ of $45 = ?$ $\frac{3}{5}$ of $45 = ?$ $\frac{2}{5}$ of $45 = ?$ $\frac{4}{5}$ of $45 = ?$
11. $\frac{1}{5}$ of $50 = ?$ $\frac{1}{10}$ of $50 = ?$ $\frac{1}{5} = \frac{?}{10}$ $50 \div ? = 25$
12. What is the ratio to 50 of 5, 10, and 25?
13. What is the ratio of 50 to 5, 10, and 25?

REVIEW DRAW

14. How many eighth notes equal two quarter notes in music?
15. Write measures of music, using quarter and eighth notes.
16. What is the volume of a cube 3 in. by 4 in. by 6 in.? What is the volume of a second cube whose ratio to the first cube is $\frac{1}{2}$?

BLACKBOARD

With thumb and fingers, hold the chalk crayon partly under the palm of the hand, and use free arm movements only. It is hard to see figures on the blackboard unless they are at least two inches high, and are written very clear and white.

Write on the blackboard these numbers and add by columns and rows:

1.	1246	9223	6114	4645	8706	3139
2.	2105	4456	8000	9879	5371	2429
3.	4308	2798	7657	2986	1324	4869
4.	6756	7963	2786	4324	7542	2471

5. Write the multiplication tables.

6. Write 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

7. Write 0, 9, 8, 7, 6, 5, 4, 3, 2, 1.

8. Write and add 123, 456, 789, 143, 476, 719, 153, 486, 729, 163, 496, 739, 173, 406, 183, 416.

PAPER

Write with a soft lead pencil or with pen and ink. If a pencil is so hard that its graphite must be softened by moisture from any source, it is too hard for the use to which it is being put.

Most children, if asked to try, soon make figures both clear and beautiful.

1. Write a *number table* from 1 to 100.

2. Write all the *odd* numbers in a *number table* from 1 to 199.

3. Write all the *even* numbers in a *number table* from 2 to 200.

4. Write *number tables*, counting: by threes to 300; by fours to 400; by fives to 500; by sixes to 600; by sevens to 700; by eights to 800; by nines to 900; by tens to 1000; by elevens to 1100; and by twelves to 1200.

Spelling of Number Names

5. 1, one. 2, two. 3, three. 4, four. 5, five. 6, six.
7, seven. 8, eight. 9, nine. 10, ten. 0, zero.
11, eleven. 12, twelve. 13, thirteen. 14, fourteen.
15, fifteen. 16, sixteen. 17, seventeen. 18, eighteen.
19, nineteen. 20, twenty. 30, thirty. 40, forty.
50, fifty. 60, sixty. 70, seventy. 80, eighty.
90, ninety. 100, one hundred. 1000, one thousand.
Spell orally as well as in writing.

6. Write in words all the numbers in questions **1, 2, 3,** and **4** on page 10. Spell the words carefully.

NUMERATION TABLE

Periods	4th Billions			3d Millions			2d Thousands			1st Units		
Orders	3d hundreds	2d tens	1st units	3d hundreds	2d tens	1st units	3d hundreds	2d tens	1st units	3d hundreds	2d tens	1st units
	8	1	6	3	2	4	8	5	5	9	3	2

In the left-hand period of a number there may be one, two, or three figures, but in every other period there must be three figures.

In reading numbers we begin with the left-hand period.

1. Read the number in the table: Eight hundred sixteen billion, three hundred twenty-four million, eight hundred fifty-five thousand, nine hundred thirty-two.

2. Read: 70,203; 288,691; 830,020; 700,014; 1,199,001; 3,910,001; 10,660,608; 25,877,707; 100,767,100; 475,658,293; 1,500,000,000; 100,100,100,100.

3. How many figures are needed to write one million?

4. Write 555 in the first three periods, and read the number 555,555,555. Five hundred fifty-five million, five hundred fifty-five thousand, five hundred fifty-five.

Write by figures:

5. Ten thousand, two hundred sixteen.

6. Thirty-seven thousand, five hundred twenty-two.

7. Sixty-nine thousand, seven hundred forty-six.

8. Four hundred thirty-nine thousand, six hundred.

9. Nine million, two hundred sixty thousand, twelve.

10. Eight billion, one hundred million, seventy-one thousand, four.

NUMBERS

One hundred one	101
One hundred eleven . . .	111
One hundred twenty . . .	120
One hundred ninety-nine .	199
Two hundred	200
Two hundred seven . . .	207
Two hundred eighty-eight .	288
Three hundred thirty . .	330
Six hundred sixty-six . .	666
Eight hundred	800
Eight hundred eighty . .	880
Nine hundred ninety-one .	991

1. Cover the figures and read the numbers, telling what figures would represent them.

2. Cover the words, and read the figures in words.

3. Explain why we use the zero in each of these different cases.

4. Write the figures for these numbers:

a. Seven hundred thousand, one hundred ten.

b. One million, two hundred nineteen thousand, seven.

c. Nine million, five hundred twenty thousand, two hundred twenty.

d. Twenty-five million, four hundred eighty-six thousand, three hundred fifteen.

e. Five hundred fifty-five million, six hundred thirty-four-thousand, twenty-two.

f. Three hundred ninety-one million, twenty thousand, one hundred twenty-eight.

5. Count by hundreds from 1000 to 2000 and back.

6. Count by hundreds from 99,000 to 100,000 and back.

7. Count by thousands from 101,000 to 121,000.

8. Count by ten-thousands from 900,000 to 1,000,000.

9. In the number 801,007,010 are how many units? tens? hundreds? thousands? ten-thousands? hundred-thousands? millions? hundred-millions?

MULTIPLICATION TABLE 8

1	11	21	31	41	51	61	71	81	91
2	12	22	**32**	42	52	62	**72**	82	92
3	13	23	33	43	53	63	73	83	93
4	14	**24**	34	44	54	**64**	74	84	94
5	15	25	35	45	55	65	75	85	95
6	**16**	26	36	46	**56**	66	76	86	**96**
7	17	27	37	47	57	67	77	87	97
8	18	28	38	**48**	58	68	78	**88**	98
9	19	29	39	49	59	69	79	89	99
10	20	30	**40.**	50	60	70	**80**	90	100

1. Read this table forward from 1 and backward from 100, emphasizing the numbers printed in **black face** figures.

2. Learn this table.

$8 \times 1 = 8$	$8 \times 5 = 40$	$8 \times 9 = 72$
$8 \times 2 = 16$	$8 \times 6 = 48$	$8 \times 10 = 80$
$8 \times 3 = 24$	$8 \times 7 = 56$	$8 \times 11 = 88$
$8 \times 4 = 32$	$8 \times 8 = 64$	$8 \times 12 = 96$

3. Answer: $32 \div 4 = ?$ $64 \div 8 = ?$ $88 \div 11 = ?$ $48 \div 6 = ?$
$96 \div 12 = ?$ $80 \div 10 = ?$ $72 \div 9 = ?$ $56 \div 7 = ?$ $40 \div 5 = ?$

4. Multiply

10	11	12	4	7	8	8	8	8
8	8	8	8	8	8	6	5	9

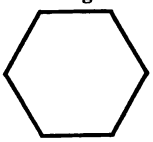
5. $64 \div 8 \div 4 = ?$ $96 \div 12 \div 6 = ?$ $6 \times 2 \times 4 = ?$
$24 \div 3 \times 6 = ?$ $88 \div 11 \div 4 = ?$ $72 \div 8 \div 3 = ?$

6. What is the highest number that multiplied by 12 gives a number less than 100? Notice that $2 \times 12 = ?$ $3 \times 12 = ?$ $4 \times 12 = ?$ $5 \times 12 = ?$ $6 \times 12 = ?$ $7 \times 12 = ?$ $8 \times 12 = ?$ Add another 12 to 8×12. $9 \times 12 = ?$

MANY-SIDED FIGURES

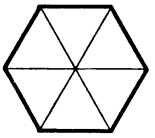
The bees always make their cells with six sides of equal length. A figure with six equal sides is called a hexagon. We can find its center by drawing lines to opposite angles. Where the lines cross is the center of the hexagon. These lines divide the hexagon into six equal parts.

Hexagon

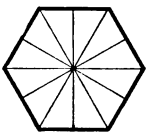


Each one of these equal parts is a triangle. If we divide each side of the hexagon into two equal parts, and draw a line inside of each triangle from the center of the hexagon to the middle point of each side, the hexagon will have twelve equal parts and twelve triangles.

Sixths



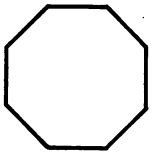
Twelfths



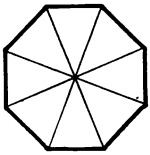
1. Point out $\frac{1}{6}$ of the hexagon; $\frac{2}{6}$; $\frac{3}{6}$.
2. Point out $\frac{1}{12}$ of the hexagon; $\frac{2}{12}$; $\frac{3}{12}$; $\frac{4}{12}$; $\frac{5}{12}$; $\frac{6}{12}$.
3. Show that $\frac{1}{2} = \frac{3}{6} = \frac{6}{12}$ of the hexagon.
4. Show that $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$ of the hexagon.
5. Draw hexagons on the blackboard.
6. Cut hexagons out of paper or cardboard and show these facts.

A figure with eight sides is called an

Octagon

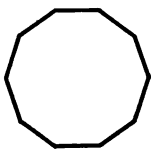


Eighths

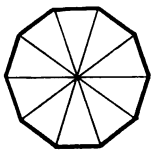


A figure with ten sides is called a

Decagon



Tenths



EQUALITY OF FRACTIONS

1. $\frac{1}{12}$ of 24 = ? $\frac{2}{12}$ of 24 = ? $\frac{3}{12}$ of 24 = ? $\frac{5}{12}$ of 24 = ? $\frac{6}{12}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{1}{2} = \frac{?}{12}$.

2. $\frac{8}{12}$ of 24 = ? $\frac{10}{12}$ of 24 = ? $\frac{12}{12}$ of 24 = ?

3. $\frac{1}{6}$ of 24 = ? $\frac{2}{6}$ of 24 = ? $\frac{3}{6}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{1}{2} = \frac{?}{6}$.

4. $\frac{4}{6}$ of 24 = ? $\frac{5}{6}$ of 24 = ? $\frac{6}{6}$ of 24 = ? $\frac{1}{3}$ of 24 = ? $\frac{2}{3}$ of 24 = ? $\frac{3}{3}$ of 24 = $\frac{?}{6}$?

5. $\frac{1}{8}$ of 24 = ? $\frac{2}{8}$ of 24 = ? $\frac{1}{4}$ of 24 = ? Then $\frac{2}{8} = \frac{?}{4}$.

6. $\frac{3}{8}$ of 24 = ? $\frac{4}{8}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{4}{8} = \frac{?}{2}$.

7. $\frac{5}{8}$ of 24 = ? $\frac{6}{8}$ of 24 = ? $\frac{3}{4}$ of 24 = ? Then $\frac{6}{8} = \frac{?}{4}$.

8. $\frac{1}{2} = \frac{?}{4}$ $\frac{1}{2} = \frac{?}{6}$ $\frac{1}{2} = \frac{?}{8}$ $\frac{1}{8} = \frac{?}{12}$ $\frac{1}{2} = \frac{?}{20}$

$\frac{1}{2}$ equals any fraction of which the number of parts taken is $\frac{1}{2}$ of the whole number of equal parts. If there are ten equal parts, then $\frac{1}{2} = \frac{5}{10}$, $\frac{1}{2}$ = five of the ten equal parts.

9. $\frac{1}{3} = \frac{?}{6}$ $\frac{1}{3} = \frac{?}{9}$ $\frac{1}{3} = \frac{?}{12}$ $\frac{1}{3} = \frac{?}{15}$ $\frac{1}{2} = \frac{?}{18}$

$\frac{1}{3}$ equals any fraction of which the number of equal parts is three times the number of equal parts taken.

The **numerator** of a fraction, written above the line shows the number of parts taken, and the **denominator**, written below the line, shows the number of equal parts.

REVIEW

10. Point off into periods and read:

1000000 1217633 3939390 4000004 38714672
44699216 355466219 716219622 556623288 700015271

REVIEW

1. If there are a dozen buttons on a card, how many buttons are there on 9 cards? on 5 cards? on a dozen cards?

2. I paid 90¢ for 9 quarts of vinegar. What was the price of 1 quart? of 4 quarts? of 6 quarts? of 1 pint?

3. $56 was paid for 8 weeks' board. At that rate, how much money should be paid for 1 week's board? for 2 weeks' board? for 5 weeks' board?

4. How many more inches are there in $\frac{1}{2}$ of a foot than in $\frac{1}{4}$ of a foot? How many more in $\frac{1}{3}$ than in $\frac{1}{6}$ of a foot?

5. Which is cheaper, milk at 30¢ a gallon or at 8¢ a quart? Explain.

6. How many separate squares can you make with a dozen sticks? how many separate triangles?

7. One boy ran 100 yards in 15 seconds. Another boy ran 300 feet in 16 seconds. Which ran the faster?

8. A street car conductor collected in one trip one dollar in fares at a nickel each passenger. How many fares did he collect?

9. John's father needed 18 two-cent stamps for his letters to go to places in this country, and 2 five-cent stamps for letters to go to England. How much money should he give John to take to the post office to pay for letters?

10. Which is more, 2 dozen or $\frac{1}{4}$ of one hundred?

11. How many more sides has a decagon than an octagon? than a hexagon?

12. What is the ratio of $1 to 3 dimes? to 3 quarters?

EIGHT AND EIGHTHS

1. 8)24 8)27 8)30 8)32 8)36 8)39 8)40
   8)12 8)43 8)47 8)9 8)14 8)51 8)57
   8)19 8)60 8)64 8)15 8)69 8)72 8)79
   8)83 8)88 8)17 8)96 8)120 8)144 8)192

2. $\frac{1}{8}$ of 80 = ? $\frac{3}{8}$ of 80 = ? $\frac{1}{8}$ of 56 = ? $\frac{5}{8}$ of 56 = ?
   $\frac{1}{8}$ of 32 = ? $\frac{2}{8}$ of 32 = ? $\frac{1}{8}$ of 88 = ? $\frac{4}{8}$ of 88 = ?
   $\frac{1}{8}$ of 8 = ? $\frac{2}{8}$ of 8 = ? $\frac{3}{8}$ of 8 = ? $\frac{6}{8}$ of 8 = ?
   $\frac{1}{8}$ of 24 = ? $\frac{6}{8}$ of 24 = ? $\frac{1}{8}$ of 16 = ? $\frac{5}{8}$ of 16 = ?
   $\frac{1}{8}$ of 72 = ? $\frac{7}{8}$ of 72 = ? $\frac{1}{8}$ of 64 = ? $\frac{7}{8}$ of 64 = ?
   $\frac{1}{8}$ of 96 = ? $\frac{5}{8}$ of 96 = ? $\frac{1}{8}$ of 48 = ? $\frac{4}{8}$ of 48 = ?
   $\frac{1}{8}$ of 40 = ? $\frac{3}{8}$ of 40 = ? $\frac{5}{8}$ of 24 = ? $\frac{7}{8}$ of 40 = ?

3. Copy and answer:

$2\times8=?$	$7\times8=?$	$12\times8=?$	$72\div8=?$	$24\div8=?$
$9\times8=?$	$3\times8=?$	$8\times8=?$	$64\div8=?$	$96\div8=?$
$1\times8=?$	$5\times8=?$	$4\times8=?$	$32\div8=?$	$40\div8=?$
$6\times8=?$	$11\times8=?$	$10\times8=?$	$56\div8=?$	$88\div8=?$
$56=?\times8$	$64=?\times8$	$16=?\times8$	$16\div8=?$	$88=?\times8$
$32=?\times8$	$72=?\times8$	$96=?\times8$	$48\div8=?$	$48=?\times8$
$80=?\times8$	$8=?\times1$	$40=?\times8$	$80\div8=?$	$24=?\times8$

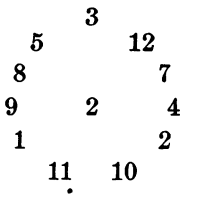
4. What is the ratio to 96: of 6; 8; 12; 24; and 32?

5. What is the ratio of 96: to 6; 8; 12; 24; and 32?

6. $\frac{1}{8}$ of 40 = ? $\frac{2}{8}$ of 40 = ? $\frac{1}{4}$ of 40 = ? $\frac{1}{4}=\frac{?}{8}$

REVIEW

This circle list may be used as the outline of many different drills.



1. What is 2×2? 2×7?
2. What is $(2 \times 12) + 7$?
3. Add all the way round: $12 + 7 + 4$, and so on to 3.
4. Add in 2 each time: $12 + 2 + 7 + 2$, and so on to 3.
5. Begin at other numbers, 7 or 4 or 2, and do as in **3** and **4**.
6. Go around in the opposite way: $3 + 5 + 8$, and so on to 12.
7. Add any two numbers and subtract the next, or subtract the center number.
8. Divide 12 by 2, 7 by 2, and so on.
9. Substitute for 2, or any other number of units, the fractions one half, one third, and so on.
10. Use a large number at the center, 24, 36, 60, 96, or 100, and divide it by each number of the circle list.
11. Call these numbers 12 minutes, 12 apples, 12 cents, and let the pupils make problems.
12. Point at the same time to any two numbers, using two pointers; add, subtract, multiply, or divide at sight.
13. Give the ratios of 12 to 7, 12 to 4, and so on; of 7 to 3, 7 to 5, and so on.
14. Draw pictures to illustrate the questions in **13**.
15. If sugar is 5¢ a lb., milk is 7¢ a qt., eggs are 2¢ each, bread is 8¢ a loaf, and so for a list to be made beside the "watch," let Mary and John and William try to find the costs of the number of pounds or of things put on the face of the watch.

DOLLARS AND CENTS

$ is the sign for dollars. $5 $8 $2

¢ is the sign for cents. 30¢ 25¢ 75¢

We do not write five dollars and thirty cents, using the signs for both dollars and cents, but the sign for dollars only with a period . called the **decimal** point. $5.30, $8.25, $2.75.

The decimal point is always placed after the number of dollars and before the number of cents.

Twenty-one dollars forty cents	$21.40
Sixty-two dollars ten cents	62.10
Thirty-four dollars seventy cents . . .	34.70
	$118.20

Let us add these:

100¢ = $1. The cents here make altogether 120¢.

120¢ = $1 + 20¢ over = $1.20.

	1.	2.	3.	4.	5.
Add	$3.25	$2.60	$ 3.10	$ 4.25	$13.22
	2.45	4.20	20.35	13.75	.51
	3.61	5.55	6.70	19.00	17.54

When we add dollars and cents together, we must be very careful to add the units of cents together and the tens of cents together, and the units of dollars and the tens of dollars together.

There are never any hundreds of cents to add together, because hundreds of cents are units of dollars.

200¢ = $? 300¢ = $? 500¢ = $? 800¢ = $?

6. Add $3.52, 51¢, and $7 together. Write in columns.

7. Add $1, $4.39, and $21.50 together. Write $1.00 for $1.

MULTIPLICATION

Products not over 100.

8×12 12×8 3×32 32×3 } $= ?$	5×9 9×5 3×15 15×3 } $= ?$	5×6 3×10 6×5 10×3 } $= ?$	8×4 2×16 4×8 16×2 } $= ?$
9×8 6×12 8×9 12×6 } $= ?$	4×12 6×8 12×4 8×6 } $= ?$	3×6 2×9 6×3 9×2 } $= ?$	2×6 3×4 6×2 4×3 } $= ?$
9×11 11×9 3×33 33×3 } $= ?$	8×10 4×20 10×8 20×4 } $= ?$	2×10 5×4 10×2 4×5 } $= ?$	7×10 10×7 2×35 35×2 } $= ?$
9×6 6×9 2×27 27×2 } $= ?$	6×10 5×12 10×6 12×5 } $= ?$	6×7 7×6 2×21 21×2 } $= ?$	5×10 2×25 10×5 25×2 } $= ?$
4×4 8×2 2×8 3×12 } $= ?$	7×5 5×7 } $= ?$ 7×8 8×7 } $= ?$	7×3 3×7 } $= ?$ 2×7 7×2 } $= ?$	11×8 8×11 } $= ?$ 3×9 9×3 } $= ?$
6×6 12×3 4×9 2×18 9×4 18×2 } $= ?$	8×3 6×4 3×8 2×12 4×6 12×2 } $= ?$	4×10 8×5 10×4 5×8 2×20 20×2 } $= ?$	10×10 2×50 50×2 4×25 25×4 $9 \times 9 = ?$

DOLLARS AND CENTS

1. Add \$2.50, \$1.35, and \$2.45; to their sum add 70¢.
2. Add \$1.20, \$3.20, \$2.05, and \$3.
3. \$1.50 .05 .10 1.00 — Add and tell why we use each of the zeros that you see in the four different numbers of dollars and cents.

4. From \$2.40 take \$1.30.

\$2.40 − 1.30 = \$1.10

0¢ less 0¢ are 0¢. Write 0 in units' place. 4 tens ¢ less 3 tens ¢ are 1 ten ¢. \$2 less \$1 is \$1. The *decimal point* in the answer divides the ¢ from the \$.

5. Subtract

\$2.75	\$3.85	\$12.90	\$8.35	\$6.40
1.45	1.85	9.85	7.25	.03

6. From \$2.45 take \$1.98.

\$2.45 − 1.98 = .47

We cannot take from 5¢ 8¢, but from 4 tens ¢ we can take 1 ten ¢. 15¢ − 8¢ = 7¢. We cannot take 9 tens ¢ from 3 tens ¢, but from 20 tens ¢ we can take 10 tens ¢.

13 tens − 9 tens = 4 tens. \$1 − \$1 = \$0.

7. Subtract

\$3.60	\$2.15	\$10.20	\$20.00	\$32.15
1.75	.90	3.50	8.75	10.00

8. Mary had three dollars and seventy cents, and spent one dollar and a quarter for a beautiful doll. How much money had she left?

9. Sam had eight dollars, and spent six dollars and forty-five cents for a leather-covered football. How much money had he left?

10. Which is more, a thousand cents or eleven dollars?

GENERAL REVIEW

1. Subtract $\frac{1}{3}$ of 9 from $\frac{2}{3}$ of 12.

2. John needed 39 more apples in order to have twelve dozen. How many did he have?

3. Draw three oblongs 1×2 in. Divide the first into halves, the second into fourths, and the third into eighths.

4. What is the ratio of $\frac{1}{8}$ to $\frac{1}{2}$? of $\frac{1}{4}$ to $\frac{1}{8}$?

5. Draw a square with an area of 16 sq. in.

6. What is the volume in cubic inches of a cube $2 \times 3 \times 4$?

7. Mary sold $\frac{5}{6}$ of two dozen eggs for 40¢. What price did she receive for each egg?

8. Write in words these numbers:

110,452; 1:800.100; 207,907; 4,090,000; and 1010000.

9. Draw a hexagon and divide it into twelfths.

10. $\frac{3}{4} = \frac{?}{8}$ $\frac{2}{3} = \frac{?}{15}$ $\frac{1}{5} = \frac{?}{10}$ $\frac{4}{4} = \frac{?}{9}$

11. His father gave Tom $1.78 for a wagon. Tom already had $1.39. He then spent $3.10 for a football. How much money had he left?

12. Draw a music measure in $\frac{4}{4}$ time, and place two eighth notes, one half note, and as many quarter notes in it as are necessary altogether to make one whole note of time in the measure.

13. What is the ratio of 7 apples to 1 apple? of 10 boys to 100 boys? of 1000 soldiers to 500 soldiers?

14. Draw an acute, a right, and an obtuse angle.

WEIGHT MEASURE

2000 pounds = 1 ton. 2000 lbs. = 1 T.

1. A man can make a bicycle weighing 25 pounds go 12 miles in an hour. A horse can draw a ton of coal in a wagon weighing half a ton on a good road 6 miles in an hour. How many pounds is the horse pulling? How much faster does the man travel? How many times heavier is the load of the horse?

2. Can you find out the following facts? How many tons does a freight locomotive weigh? How many tons does a loaded freight car weigh? How many loaded cars can the locomotive draw on a level track? How many miles an hour can a freight locomotive travel, drawing a heavy train of cars?

3. How many pounds do you think a buggy weighs? an ordinary carriage? a good carriage-horse? a cow? a ten-year-old boy?

4. Did you ever notice how large a pile a ton of coal makes? Do you know how much a hod of coal weighs?

16 ounces = 1 pound. 16 oz. = 1 lb.

5. Mrs. Eaton bought $\frac{1}{4}$ of a pound of tea and $\frac{1}{2}$ of a pound of coffee. How many ounces did she buy in all?

6. She ordered a half ton of coal at the coal dealer's. How many pounds did she order?

7. She paid for the tea at the rate of 40¢ per lb., and for the coffee at the rate of 30¢ per lb. How much in all did she pay the grocer?

8. The coal she bought cost $5 per T. How many dollars did she pay for the coal?

MULTIPLICATION

Multiplication repeats one number as many times as there are units in another.

The number repeated, or multiplied, is the **multiplicand.**

The number showing how many times the multiplicand is repeated is the **multiplier.**

The result of the multiplication is the **product.**

The sign × is read **times** or **multiplied by.**

$7 \times 5 = 35$ is read **five times seven are thirty-five,** or, **seven multiplied by five are thirty-five.**

1. Find 5×17.

$17 = 7 + 10$

$5 \times 7 = 35$

$5 \times 10 = 50$

$17 \times 5 = 85$

Thus:

17	multiplicand
5	multiplier
85	product

In multiplying, however, we find it better not to write the number of tens, but to remember them and add them to the result when we multiply the tens in the multiplicand.

2. Find 7×15.

$7 \times 5 = 35$

$7 \times 10 = 70$

$7 \times 15 = 105$

Though we must understand multiplication in this way, we should learn to write the process in a simpler way.

15
7
105

3. Find 9×25.

$25 = 5 + 20$

$9 \times 5 = 45$

$9 \times 20 = 180$

$9 \times 25 = 225$

45	25	multiplicand
180	9	multiplier
225	225	product

4. Multiply:

16	15	13	14	20	17	18
4	5	7	5	6	7	6

QUESTIONS

MULTIPLICATION AND ADDITION

3 7 4 9 5 11 2 10 6 8 12

1. Multiply each of these numbers by:

4 6 2 10 5 8 3 9 7 11 12

2. *Multiply* the numbers by:

a	*b*	*c*
4 and add 2	6 and add 2	11 and add 4
d	*e*	*f*
6 and add 1	12 and add 5	10 and add 5
g	*h*	*i*
8 and add 4	11 and add 5	10 and add 10
j	*k*	*l*
9 and add 3	12 and add 2	5 and add 6
m	*n*	*o*
7 and add 4	10 and add 7	8 and add 4
p	*q*	*r*
10 and add 9	12 and add 6	6 and add 3
s	*t*	*u*
2 and add 6	10 and add 8	9 and add 8
v	*w*	*x*
4 and add 5	5 and add 4	11 and add 3
y	*z*	*aa*
7 and add 9	8 and add 6	5 and add 12

3. For 6 days Willie made 12¢ a day selling papers. How many cents in all did he make? His mother gave him 11¢ more. How much money did he then have?

REVIEW

1.	2.	3.	4.	5.	6.	7.	8.
8)24	9)45	2)16	5)35	7)14	3)8	2)30	6)54
6)42	2)11	6)48	3)9	5)30	7)35	9)63	10)50
10)20	10)80	5)50	9)18	8)24	3)21	2)7	7)42
8)18	3)23	5)52	9)72	3)10	4)36	4)16	10)60
12)48	6)54	4)8	7)21	7)28	4)32	7)84	6)12
5)15	8)32	7)63	8)72	11)55	7)56	2)22	9)81
4)40	8)48	4)28	4)12	5)15	3)27	10)100	7)35
5)7	4)30	10)70	2)4	8)16	6)30	3)13	4)4
5)45	10)10	3)15	4)20	2)18	2)14	7)70	5)40
9)9	5)20	4)21	5)35	2)17	8)80	9)11	6)18
8)56	6)36	7)17	8)28	8)40	9)36	3)18	6)20
10)90	7)63	6)60	4)24	10)80	3)20	8)64	2)10
3)13	3)24	10)40	7)49	10)83	9)90	2)12	9)63
8)24	3)26	5)25	3)6	9)54	9)92	6)24	5)35

9.	10.	11.
$2\times3\times3\times3=?$	$2\times2\times2\times2=?$	$3\times2\times2\times2\times3=?$
$7\times2\times2\times2=?$	$2\times3\times3=?$	$3\times3\times2\times5=?$
$3\times2\times2\times5=?$	$2\times2\times5=?$	$3\times2\times2\times2\times2=?$
$3\times7\times3=?$	$2\times2\times3\times3=?$	$3\times3\times11=?$
$2\times3\times11=?$	$2\times2\times7=?$	$2\times5\times2\times5=?$
$7\times2\times5=?$	$2\times5\times3=?$	$2\times2\times2\times5=?$
$3\times2\times2\times2\times3=?$	$2\times2\times2\times2\times2=?$	$2\times3\times7=?$
$2\times2\times2\times2\times5=?$	$2\times2\times3\times3=?$	$2\times3\times2\times2\times2=?$
$3\times3\times3\times3=?$	$5\times2\times2\times5=?$	$2\times5\times5=?$

MULTIPLICATION

1. Multiply 249 by 7.

249	multiplicand		
7	multiplier	Add 7 times 249.	
1743	product		

Proof:

249
249
249
249
249
249
1743

Seven times 9 units are 63 units, equal to 6 tens and 3 units. We write 3 in units' place in the product and carry 6 tens.

Seven times 4 tens are 28 tens; then adding the 6 tens, we have 34 tens, equal to 3 hundreds and 4 tens. We write 4 in tens' place and carry 3 hundreds.

Seven times 2 hundreds are 14 hundreds; then adding the 3 hundreds, we have 17 hundreds, equal to 1 thousand and 7 hundreds. We write 7 in hundreds' place and 1 in thousands' place.

2. Multiply 4 by 370.

370	multiplicand		
4	multiplier	Add 4 times 370.	
1480	product		

Proof:

370
370
370
370
1480

3. Multiply 21 by 5 and the product by 3. $21 \times 5 \times 3 = 315$.

21	Proof: 21	105
5	21	105
105	21	105
3	21	315
315	21	
	105	

4. Multiply these numbers:

I	II	III	IV	V	VI	VII	VIII	IX
312	425	234	117	123	432	171	302	140
2	3	2	6	3	3	3	4	4

DOLLARS AND CENTS

1. Four boys had \$2.40 each. How much money had they in all? We can find this by

MULTIPLICATION

$$\begin{array}{r} \$2.40 \\ 4 \\ \hline \$9.60 \end{array}$$

We multiply just as in ordinary multiplication: $0 \times 4 = 0$. $4 \times 4 = 16$. $2 \times 4 = 8$. $8 + 1 = 9$. The period . or *decimal* point we place before the 6 to show that the 9 is \$ and the 60 represents ¢. The boys had each 40¢, but $40¢ \times 4 = 160¢$; and $160¢ = \$1 + 60¢$.

In multiplying money we set the decimal point as many figures to the left as it stood to the left in the multiplicand.

2. Multiply:

\$1.75	\$2.25	\$4.13	\$8.15	\$3.98
3	6	9	12	10

3. The price of each of 7 books was one dollar and twenty-five cents. Mary's mother bought the whole set for her. What change should she receive from a ten-dollar bill?

4. Add:

\$8.32	\$1.42	\$8.14	\$10.00	\$14.03
9.41	3.27	1.90	8.00	.10
.06	8.29	3.06	9.00	.90
2.33	.50	2.10	.25	15.00
8.21	10.00	8.25	1.75	.69

5. Subtract:

\$15.00	\$3.33	\$5.00	\$5.00	\$20.00
8.69	2.98	1.49	3.38	16.75

MULTIPLICATION

1. Multiply 5317 by 8.

5317	multiplicand
8	multiplier
42,536	product

2. Multiply 532,005 by 7.

532,005	multiplicand
7	multiplier
3,724,035	product

Multiply these numbers, and prove the answers to the first five, by either method.

3.	4.	5.	6.	7.
6342	5024	8153	3254	2150
3	4	5	6	7

8.	9.	10.	11.	12.
5346	7135	2648	6174	1342
4	5	6	7	8

13.	14.	15.	16.
42,307	18,243	72,845	16,537
5	6	7	8

17.	18.	19.	20.
71,465	32,618	47,438	19,684
4	6	7	8

21.	22.	23.	24.
43,019	27,420	426,815	371,648
3	5	7	8

1st proof of 1.

5317
5317
5317
5317
5317
5317
5317
5317
42,536

2d proof of 1.

8 7's are 56. Write 6. Carry 50.

8 10's are 80.

80 + 50 = 130.

Write 30. Carry 100.

8 300's are 2400.

2400 + 100 = 2500.

Write 500. Carry 2000.

8 5,000's are 40,000.

40,000+2,000=42,000.

6
30
500
2000
40000
42,536

DOLLARS AND CENTS

Sometimes when we multiply money, we do not have a multiplicand as large as the multiplier. The true multiplicand is always the quantity multiplied. Where the multiplier is larger than the multiplicand, we write our problem as in this case.

1. A boy sold 65 newspapers at 2¢ each. How much money did he receive?

Here the multiplicand is 2¢ and the multiplier is 65. How much is 2¢ × 65?

65	130¢ = 100¢ + 30¢
2¢	100¢ = $1. 30¢ = $.30
130¢	130¢ = $1.30

All the figures to the left of the *decimal* point, when the sign $ is used, stand for dollars, and the two figures to the right stand for cents.

We may write fifty cents either 50¢ or $.50.

10¢ = $.10. 25¢ = $.25. 6¢ = $.06. 2¢ = $.02.

2. A boy sold 91 fresh eggs at 5¢ each. How much money did he receive?

91
$.05
$4.55

Here again we use the amount to be multiplied; 5 cents, 5¢, or $.05 as the apparent multiplier.

3. Multiply 8¢ by 55, 105, 132, 69, 48, and 74.

4. Multiply $.07 by 25, 84, 125, 210, 305, and 76

5. Write with the dollar sign these amounts:

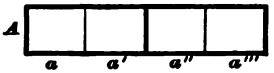
40¢, 38¢, 97¢, 49¢, 86¢, 75¢. Add them.

6. Multiply each amount in 5 by these numbers:

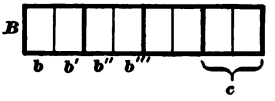
4 8 6 12 11 7 9

RATIOS, 2, 4, 8, 3, 6, 12

Halves and Fourths



Fourths and Eighths



1. Compare a, a', a'', a'''. Read these a, a prime, a second, a third.

2. Compare $a + a'$ with A.

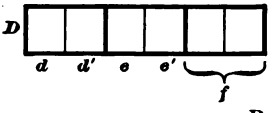
3. What part of A is a? $a + a'$? $a + a' + a''$?

4. Is it true that $\frac{1}{2}$ of A equals $\frac{2}{4}$ of A?

5. Into how many parts is B divided? What part of B is b? c? $b + b'$?

6. Is it true that $\frac{1}{2}$ of B equals $\frac{4}{8}$ of B?

Thirds and Sixths



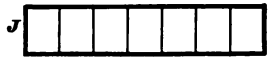
Fifths and Tenths

Read = equal

7. Does $\frac{2}{3}$ of $D = \frac{4}{6}$ of D? $\frac{4}{5}$ of $G = \frac{8}{10}$ of G?

8. Compare $d + d'$ with $e + e' + f$.

Sevenths



Twelfths

9. Is $\frac{3}{7}$ more or less than $\frac{1}{2}$? Measure.

10. Show that $\frac{3}{12} = \frac{1}{4}$; $\frac{2}{12} = \frac{1}{6}$; $\frac{4}{12} = \frac{1}{3}$; $\frac{6}{12} = \frac{1}{2}$.

11. When is the ratio of one number to another represented by a whole number? When is it represented by a fraction?

LENGTH MEASURE

3 feet = 1 yard. 3 ft. = 1 yd.

1760 yards = 1 mile = 5280 feet.

1. A bicycle rider traveled 10 miles in one hour and 8 miles in the next hour. How many yards did he travel? How many feet did he ride?

2. A horse and carriage went six miles while a bicyclist went ten miles. How many feet farther in the same time did the bicyclist travel?

3. How far is it from your house to the post office? to the baseball field? to the high school?

4. How many miles can you walk in an hour? run? skate? ride on a bicycle? drive a horse? go on an electric car? on the steam railway train?

12 inches = 1 foot. 12 in. = 1 ft.

5. In a hop, step, and jump Albert cleared 23 ft. 7 in. In the hop he cleared 72 in. and in the step 84 in. How long was the jump?

REVIEW RECITE

6. John and Tom had a dozen and a half trout which they caught in a brook. Each trout weighed about $\frac{1}{2}$ lb. How many pounds did all the trout weigh?

7. $\frac{1}{3}$ of the trout were John's. He sold them at 10¢ each. How much money did he receive?

8. The rest were Tom's. He sold his for 8¢ each. How much money did he receive? Which had the larger amount of money? How much more had he?

9. Make a drawing to show that $\frac{1}{3}$ of anything equals $\frac{2}{6}$ of it.

10. Multiply

15	20	31	64	28	71	52	31	23	25
6	7	5	4	3	7	9	12	11	8

FRACTIONS

1. Which is greater, 2×1 or $2 \times \frac{1}{2}$? Why?

2. What is $\frac{1}{4}$ of 16? $16 \div ? = 4$.

3. $\frac{3}{4}$ of 16 = ? $\frac{6}{8}$ of 16 = ? $\frac{5}{8}$ of 16 = ? $\frac{8}{8}$ of 16 = ?

4. A butcher had 16 chickens. He sold $\frac{1}{8}$ of them to 1 man and $\frac{1}{8}$ to another man. How many chickens did he sell to both men?

5. What is the ratio of 6 to 18? of 18 to 6?

6. I had 18¢ and lost $\frac{1}{3}$ of my money. How many cents did I lose?

7. $\frac{1}{6}$ of 18 = ? $\frac{2}{6}$ of 18 = ? Then $\frac{2}{6} = \frac{?}{3}$

8. $\frac{3}{6}$ of 18 = ——. $\frac{4}{6}$ of 18 = ——. $\frac{5}{6}$ of 18 = ——.

9. There were 20 books on a table. 4 of them were taken away. How many were left? What part was taken away? What part was left?

10. $\frac{2}{5}$ of 20¢ are how many cents?

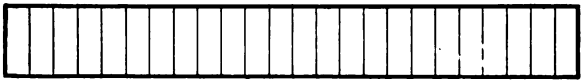
11. $\frac{3}{5}$ of 15 figs are how many figs?

12. $\frac{4}{5}$ of \$10 are how many dollars?

13. $\frac{1}{7}$ of 14 pounds are how many pounds? $\frac{2}{7}$? $\frac{3}{7}$? $\frac{4}{7}$? $\frac{5}{7}$? $\frac{6}{7}$? $\frac{7}{7}$?

14. Which is greatest and which is least, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$?

15. Would it make any difference if we asked question 14 in this way: which is greatest; $\frac{1}{4}$ of 24, $\frac{1}{6}$ of 24, or $\frac{1}{8}$ of 24? or: which is greatest; $\frac{1}{4}$, $\frac{1}{6}$ or $\frac{1}{8}$ of the oblong rectangle? $\frac{1}{4}$, $\frac{1}{6}$, or $\frac{1}{8}$ of this oblong rectangle?



16. Point out $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$ of this oblong.

FRACTIONS AND RATIOS

1. What is the ratio of 1¢ to 9¢? of 9¢ to 1¢?

2. What is the ratio of 6¢ to 1¢? of 6¢ to 3¢? of 4¢ to 2¢?

3. What part of 50 is 5? of 500 is 5?

4. What is $\frac{1}{12}$ of a dozen?

5. What is the ratio of 1 to 12? of 12 to 1?

6. If a dozen apples cost 12¢, how much would 2 apples cost? 3 doz.? 7 doz.?

7. If 7 oranges cost 14¢, how many cents would 1 orange cost? What is the ratio of 14 to 7? of 7 to 14?

8. Philip had a dime and 2¢. He paid $\frac{1}{12}$ of his money for an apple. What did the apple cost? Tell the cost of 2 apples.

9. Henry had 10 marbles. He lost 2. What part of his marbles did he lose?

10. $\frac{2}{5}$ of 10 marbles = ? $\frac{3}{5}$ of 10 marbles = ?

11. What is the ratio of 2 to 10? of 10 to 2?

12. A basket contained 14 eggs. The cook took out $\frac{1}{7}$ of them. How many eggs did she take out?

13. What is the ratio of 2 eggs to 14 eggs?

14. George had 15 pears. He gave away 3. What part did he give away?

15. What is the ratio of 3 to 15? of 15 to 3?

16. What is $\frac{1}{5}$ of 15? What are $\frac{2}{5}$ of 15?

17. Eddie had 16 cherries. He gave $\frac{1}{8}$ of them to James and $\frac{1}{8}$ to Arthur. How many eighths did he keep? How many cherries did he give to James? to Arthur? to both boys?

DIVISION

Division finds how many times one number is contained in another.

The number to be divided is called the **Dividend.**

The number we divide by is called the **Divisor.**

The result obtained by division is called the **Quotient.** It shows how many times the divisor is contained in the dividend.

When the dividend does not contain the divisor an exact number of times, the part of the dividend left undivided is called the **Remainder.** It is always less than the divisor.

The sign of division, $\div$, shows that the number before it is to be divided by the number. Thus, $10 \div 5 = 2$. Ten contains five twice. Or, 10 divided by 5 is 2.

Division is also indicated by writing the dividend above a line and the divisor below it; thus, $\frac{10}{5} = 2$.

The sign) is also used to indicate division. Thus 5)10(2 shows that 10 divided by 5 equals 2. We sometimes indicate division by this form, 8)64.

Proof. Multiply the quotient by the divisor and add the remainder, if any. If the result equals the dividend, the work is correct.

8)64	$8 \times 8 = 64$	8)216	27	quotient
8		27	8	divisor
			216	dividend

Do as is indicated by the forms given.

1. 3)429	**2.** $\frac{81}{9} = ?$	**3.** $96 \div 12 = ?$	**4.** 11)132
5. 6)737	**6.** $\frac{48}{8} = ?$	**7.** $108 \div 9 = ?$	**8.** 11)165

DIVISION

1. Divide 486 by 2.

2 is contained in 4 hundreds 2 (hundred) times. We write 2 in hundreds' place in the quotient. 2 is contained in 8 tens 4 (tens) times. We write 4 in tens' place in the quotient. 2 is contained in 6 units 3 (units) times. We write the 3 in units' place in the quotient.

$2\overline{)486}$ Proof: 243 quotient, × 2 divisor, 486 dividend

$\frac{243}{}$

To prove the result of division, multiply the quotient by the divisor. This gives the dividend.

Second proof:

$400 \div 2 = 200$
$80 \div 2 = 40$
$6 \div 2 = 3$
$486 \div 2 = 243$

2. Divide 1842 by 3.

1 cannot be divided by 2, except with a fraction as the result, but 1 thousand equals 10 hundreds. We add the 10 hundreds to the 8 hundreds and divide the 18 hundreds by 3. We write the quotient figure 6 in hundreds' place. 3 is contained in 4 tens 1 (ten) time and 1 ten over. We write 1 in tens' place in the quotient. 1 ten and 2 units are 12 units. 3 is contained in 12 units 4 (unit) times. We write 4 in the quotient.

$3\overline{)1842}$ Proof: 614 quotient, 3 divisor, 1842 dividend

$\frac{614}{}$

3. Divide 4940 by 2, 3, 4, 5, 6, and 7.

4. Divide 7264 by 3, 6, 8, 2, 4, and 7.

GENERAL REVIEW

1. Write in figures these fractions: three fourths, two fifths, one sixth, seven twelfths, nine tenths, five ninths.

2. If a line is one inch long, show by drawing other lines under it the ratios $\frac{1}{2}$, 2, 3, and 5.

3. A measure of music in $\frac{4}{4}$ time had in it four notes; of these one was a half note and another was a quarter note. The other two were equal. What were they?

4. The minute hand was two fifths of the way around the clock from XII. How many minutes was it past twelve?

5. What is the ratio of 20 minutes to an hour? Draw a circle to show this.

6. Draw a pentagon and divide it into ten equal parts.

7. Write three fractions that equal one third.

8. What fraction with a unit as its numerator equals two eighths? three twelfths? Show these facts by drawings.

9. What is the volume of a cube $\frac{1}{2}$ in. $\times$ 3 in. $\times$ 6 in.?

10. What is a fraction?

11. Write in words these numbers: 1070, $\frac{7}{8}$, 1214860.

12. Which is larger, one eighth or one tenth of anything?

13. John bought a quarter's worth of eggs at 15¢ a dozen. How many did he buy?

14. Mary bought six slate pencils for 2¢; but Tom got ten for 4¢. Whose pencils were cheaper? Why?

15. It was 150° in the sun, but 98° in the shade. What was the difference in number of degrees?

MULTIPLICATION TABLE, 9

9 gives us an interesting multiplication table.

1	11	21	31	41	51	61	71	**81**	91	101	111	121
2	12	22	32	42	52	62	**72**	82	92	102	112	122
3	13	23	33	43	53	**63**	73	83	93	103	113	123
4	14	24	34	44	**54**	64	74	84	94	104	114	124
5	15	25	35	**45**	55	65	75	85	95	105	115	125
6	16	26	**36**	46	56	66	76	86	96	106	116	**126**
7	17	**27**	37	47	57	67	77	87	97	107	**117**	127
8	**18**	28	38	48	58	68	78	88	98	**108**	118	128
9	19	29	39	49	59	69	79	89	**99**	109	119	129
10	20	30	40	50	60	70	80	**90**	100	110	120	130

1. Notice that the multiples of 9 in this *number table* present the appearance of steps, in lines like stairs.

A **multiple** is the product of one number by another.

2. Add 1 and 8; 2 and 7; 3 and 6; 1 and 1 and 7; 1 and 2 and 6. Notice that the sum of the figures in any multiple of 9 is always 9, or another multiple of 9, *e.g.* 9 + 9.

3. Learn this table:

$9 \times 1 = 9$	$9 \times 5 = 45$	$9 \times 9 = 81$
$9 \times 2 = 18$	$9 \times 6 = 54$	$9 \times 10 = 90$
$9 \times 3 = 27$	$9 \times 7 = 63$	$9 \times 11 = 99$
$9 \times 4 = 36$	$9 \times 8 = 72$	$9 \times 12 = 108$

4. Answer: $3\overline{)9}$ $18 \div 9 = ?$ $18 \div 6 = ?$ $18 \div 2 = ?$ $18 \div 3 \div 3 = ?$ $3\overline{)27}$ $36 \div 9 = ?$ $36 \div 12 = ?$ $36 \div 6 = ?$ $5\overline{)45}$ $9\overline{)54}$ $7\overline{)63}$ $8\overline{)72}$ $9\overline{)81}$ $10\overline{)90}$ $11\overline{)99}$ $9\overline{)108}$

5. In what other multiplication tables do we have the multiples of 9 as far as 100?

MULTIPLICATION TABLE, 7

1	11	**21**	31	41	51	61	71	81	**91**
2	12	22	32	**42**	52	62	72	82	92
3	13	23	33	43	53	**63**	73	83	93
4	**14**	24	34	44	54	64	74	**84**	94
5	15	25	**35**	45	55	65	75	85	95
6	16	26	36	46	**56**	66	76	86	96
7	17	27	37	47	57	67	**77**	87	97
8	18	**28**	38	48	58	68	78	88	**98**
9	19	29	39	**49**	59	69	79	89	99
10	20	30	40	50	60	**70**	80	90	100

1. Write this number table in two colors.

2. Counting by ones, we find one seven in seven and two sevens in fourteen. How many sevens do we find in 21? in 28? in 35? in 42? in 49? in 56? in 63? in 70? in 77? in 84?

3. Do you notice to what number of times we carry each multiplication table?

4. Learn this table:

$7 \times 1 = 7$	$7 \times 5 = 35$	$7 \times 9 = 63$
$7 \times 2 = 14$	$7 \times 6 = 42$	$7 \times 10 = 70$
$7 \times 3 = 21$	$7 \times 7 = 49$	$7 \times 11 = 77$
$7 \times 4 = 28$	$7 \times 8 = 56$	$7 \times 12 = 84$

5. Answer: $49 \div 7 =$ $77 \div 11 =$ $84 \div 12 =$ $35 \div 7 =$?
$56 \div 7 =$ $63 \div 9 =$ $28 \div 7 =$ $70 \div 7 =$ $42 \div 6 =$?

6. Multiply:

8	7	12	11	6	9	10	4	5
7	7	7	7	7	7	7	7	7

FRACTIONS AND RATIOS

1. How many 7's are there in 14? in 7? in 8? in 10? in 11? in 13? in 15? in 17? in 20?

2. $\frac{1}{7}$ of 14 = ? $\frac{2}{7}$ of 14 = ?

3. At 2¢ apiece, what will be the cost of 7 oranges?

4. If there are 14 boys in a class, how many boys are there in $\frac{1}{7}$ of the class?

5. Divide 14 oranges equally among 7 boys. How many oranges will each boy have?

6. What is the ratio of 8 to 16? of 16 to 8? of 8 to 8?

10 ÷ 8 = ? 12 ÷ 8 = ? 15 ÷ 8 = ? 19 ÷ 8 = ?

7. 8)9 8)11 8)13 8)14 8)17 8)20

8. If 8 cakes cost 16¢, what will be the cost of 1 cake? of 2 cakes? of 4 cakes? of 7 cakes?

9. If apples are 2¢ apiece, how many can one buy for 16¢?

10. Arthur had 16 marbles. He gave $\frac{1}{8}$ of them to Willie. How many marbles did Willie get?

11. What is the ratio of 9 to 18? of 18 to 9?

12. $\frac{1}{9}$ of 18 = ? $\frac{1}{2}$ of 18 = ?

13. 12 ÷ 9 = ? 14 ÷ 9 = ? 17 ÷ 9 = ? 20 ÷ 9 = ?

14. 9)11 9)13 9)15 9)19 9)16 9)18

15. Edith had 18 pinks. She gave $\frac{1}{9}$ of them to Louise. How many pinks did Louise get?

16. I bought 9 pencils at 2¢ each. How many cents did I spend?

17. Arthur paid 2¢ for a banana, 6¢ for oranges, and 10¢ for apples. How many cents did he spend?

18. What is $\frac{2}{9}$ of 18¢ = ? $\frac{3}{9}$ of 18¢ = ? $\frac{5}{9}$ of 18¢ = ?

FRACTIONS

1. What is $\frac{1}{9}$ of 27? $\frac{1}{3}$ of 27 = ? $\frac{2}{9}$ of 27 = ? $\frac{3}{9}$ of 27 = ? $\frac{3}{9}$ = what other fraction?

2. $\frac{4}{9}$ of 27 = ? $\frac{5}{9}$ of 27 = ? $\frac{8}{9}$ of 27 = ? $\frac{2}{3}$ of 27 = ? $\frac{6}{9}$ of 27 = ? Then $\frac{2}{3}$ = what other fraction?

3. What is $\frac{1}{3}$ of 30? $\frac{2}{3}$ of 30? $\frac{3}{3}$ of 30?

4. What is $\frac{1}{4}$ of 40? $\frac{2}{4}$ of 40? $\frac{3}{4}$ of 40? $\frac{4}{4}$ of 40?

5. What is $\frac{1}{5}$ of 50? $\frac{3}{5}$ of 50? $\frac{5}{5}$ of 50?

6. What is $\frac{1}{6}$ of 60? $\frac{2}{6}$ of 60? $\frac{4}{6}$ of 60? $\frac{5}{6}$ of 60?

7. What is $\frac{1}{7}$ of 70? $\frac{3}{7}$ of 70? $\frac{6}{7}$ of 70?

8. What is $\frac{1}{8}$ of 80? $\frac{4}{8}$ of 80? $\frac{7}{8}$ of 80?

9. $10\overline{)20}$ $\frac{1}{10}$ of 20 = ? $\frac{1}{10}$ of 30 = ? $10\overline{)30}$ $\frac{2}{10}$ of 30 = ?

10. $\frac{1}{10}$ of 40 = ? $10\overline{)40}$ $10\overline{)50}$ $\frac{1}{10}$ of 50 = ? $\frac{3}{10}$ of 50 = ?

11. $\frac{1}{10}$ of 60 = ? $10\overline{)60}$ $\frac{1}{10}$ of 70 = ? $10\overline{)70}$ $\frac{2}{10}$ of 70 = ?

12. $10\overline{)80}$ $\frac{1}{10}$ of 80 = ? $10\overline{)90}$ $\frac{1}{10}$ of 90 = ? $10\overline{)100}$ $\frac{1}{10}$ of 100 = ?

13. How many 9's are there in 81? $\frac{1}{9}$ of 81 = ? $9 \times 9 = ?$ $81 + 9 = ?$

14. How many 9's are there in 90? $90 = 9 \times ?$

15. What is $\frac{1}{9}$ of 90? $\frac{1}{10}$ of 90 = ?

16. How many 10's are there in 90? $10 \times 9 = ?$

17. Divide 245 by 4 exactly.

$4\overline{)245}$
$61\frac{1}{4}$

4 is contained in 24 tens 6 times, without remainder. 4 is contained in 5 once, with 1 unit remaining. $1 \div 4 = \frac{1}{4}$.

18. Divide 267 by 4, 5, 3, 7, 9, and 8.

SEVEN AND SEVENTHS

1. 7)21 7)23 7)26 7)35 7)39 7)44 7)48
7)55 7)60 7)66 7)69 7)72 7)78 7)80 7)83

2. How many 7's are there in:

35? 42? 84? 49? 14? 21? 56? 7? 28? 63? 77? 70?

3.

$\frac{1}{7}$ of 14 = ?	$\frac{2}{7}$ of 14 = ?	$\frac{3}{7}$ of 14 = ?	$\frac{4}{7}$ of 14 = ?
$\frac{5}{7}$ of 14 = ?	$\frac{6}{7}$ of 14 = ?	$\frac{7}{7}$ of 14 = ?	$\frac{1}{7}$ of 7 = ?
$\frac{4}{7}$ of 7 = ?	$\frac{1}{7}$ of 77 = ?	$\frac{3}{7}$ of 77 = ?	$\frac{1}{7}$ of 42 = ?
$\frac{6}{7}$ of 42 = ?	$\frac{1}{7}$ of 49 = ?	$\frac{5}{7}$ of 49 = ?	$\frac{1}{7}$ of 28 = ?
$\frac{3}{7}$ of 28 = ?	$\frac{1}{7}$ of 84 = ?	$\frac{4}{7}$ of 84 = ?	$\frac{1}{7}$ of 35 = ?
$\frac{7}{7}$ of 35 = ?	$\frac{1}{7}$ of 21 = ?	$\frac{6}{7}$ of 21 = ?	$\frac{1}{7}$ of 70 = ?
$\frac{4}{7}$ of 70 = ?	$\frac{1}{7}$ of 63 = ?	$\frac{5}{7}$ of 63 = ?	$\frac{1}{7}$ of 56 = ?
$\frac{3}{7}$ of 56 = ?	$\frac{6}{7}$ of 14 = ?	$\frac{1}{7}$ of 84 = ?	$\frac{2}{7}$ of 42 = ?
$\frac{4}{7}$ of 21 = ?	$\frac{3}{7}$ of 28 = ?	$\frac{2}{7}$ of 70 = ?	$\frac{4}{7}$ of 35 = ?
$\frac{4}{7}$ of 28 = ?	$\frac{2}{7}$ of 56 = ?	$\frac{5}{7}$ of 49 = ?	$\frac{3}{7}$ of 21 = ?

4. What is the ratio of 7 to 49? of 49 to 7? of 77 to 7? of 14 to 7? of 7 to 63? of 7 to 84?

5. $\frac{1}{8}$ is the ratio of 7 to — ? $\frac{1}{2}$ is the ratio of 7 to — ?

6. $\frac{1}{12}$ is the ratio of 7 to — ? $\frac{1}{9}$ is the ratio of 7 to — ?

7. 2 is the ratio of 14 to — ? 4 is the ratio of 28 to — ?

8. 12 is the ratio of 84 to — ? 5 is the ratio of 35 to — ?

MULTIPLICATION TABLE, 11.

The number 11 gives us the easiest multiplication table.

1	**11**	21	31	41	51	61	71	81	91	101	111	**121**	131	141
2	12	**22**	32	42	52	62	72	82	92	102	112	122	**132**	142
3	13	23	**33**	43	53	63	73	83	93	103	113	123	133	**143**
4	14	24	34	**44**	54	64	74	84	94	104	114	124	134	144
5	15	25	35	45	**55**	65	75	85	95	105	115	125	135	145
6	16	26	36	46	56	**66**	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	**77**	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	**88**	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	**99**	109	119	129	139	149
10	20	30	40	50	60	70	80	90	100	**110**	120	130	140	150

1. The multiples of 11 in black face figures, like the multiples of 9, make a line of stairs in the *number table.*

2. In all multiples of 11 below 100 the figures for units and tens are the same.

3. Learn this table:

$11 \times 1 = 11$	$11 \times 5 = 55$	$11 \times 9 = 99$
$11 \times 2 = 22$	$11 \times 6 = 66$	$11 \times 10 = 110$
$11 \times 3 = 33$	$11 \times 7 = 77$	$11 \times 11 = 121$
$11 \times 4 = 44$	$11 \times 8 = 88$	$11 \times 12 = 132$

4. Answer: $2 \times 2 \times 11 = ?$ $8)\underline{88}$ $7 \times 11 = ?$ $11 \times 5 = ?$ $132 \div 11 = ?$ $11 \times 11 = ?$ $3 \times 3 \times 11 = ?$ $3 \times 2 \times 11 = ?$ $11)\underline{99}$ $3 \times 2 \times 2 \times 11 = ?$ $11 \times 3 = ?$ $11)\underline{110}$ $12)\underline{132}$

5. Of these numbers, which can be divided evenly without remainders by other numbers — 4, 5, 6, 7, 8, 9, 10, 11, 12?

MULTIPLICATION TABLE, 12

The number 12 is the last and largest number whose multiples we study very carefully. We do not need to use the multiples of still larger numbers very often. If we learn accurately the multiples of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, we can multiply larger numbers rapidly when necessary.

1	11	21	31	41	51	61	71	81	91	101	111	121	131	141
2	**12**	22	32	42	52	62	**72**	82	92	102	112	122	**132**	142
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143
4	14	**24**	34	44	54	64	74	**84**	94	104	114	124	134	**144**
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
6	16	26	**36**	46	56	66	76	86	**96**	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	**48**	58	68	78	88	98	**108**	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
10	20	30	40	50	**60**	70	80	90	100	110	**120**	130	140	150

1. Why is every multiple of 12 a multiple also of 2, of 3, of 4, and of 6? Try every number in black face type in this *number table* by division, and see if this is true; divide each black face number by 2, 3, 4, and 6.

2. Learn this table:

$12 \times 1 = 12$	$12 \times 5 = 60$	$12 \times 9 = 108$
$12 \times 2 = 24$	$12 \times 6 = 72$	$12 \times 10 = 120$
$12 \times 3 = 36$	$12 \times 7 = 84$	$12 \times 11 = 132$
$12 \times 4 = 48$	$12 \times 8 = 96$	$12 \times 12 = 144$

3. Notice that we have studied the multiplication tables in this order: 2, then 4; 5, then 10; 3, then 6; next 8; next 9; then 7 and 11; and last 12. $4 = ? \times 2$. $10 = ? \times 5$. $6 = ? \times 3$. $8 = ? \times 4$. $9 = ? \times 3$. $12 = 2 \times 2 \times 3$. $7 \times 12 = ?$ $11 \times 12 = ?$ $12 \times 12 = ?$

REVIEW

1. How many 9's are there in 99? $\frac{1}{9}$ of 99 = ?
$\frac{2}{9}$ of 99 = ? $\frac{3}{9}$ of 99 = ? $\frac{5}{9}$ of 99 = ? $\frac{7}{9}$ of 99 = ? $\frac{8}{9}$ of 99 = ?

2. $11 \times 12 = ?$ $12 \times 11 = ?$ $132 \div 12 = ?$ $132 \div 11 = ?$

3. How many 12's are there in 132? How many 11's?
$\frac{1}{12}$ of 132 = ? $\frac{1}{11}$ of 132 = ? $\frac{2}{12}$ of 132 = ? $\frac{3}{12}$ of 132 = ?
$\frac{7}{12}$ of 132 = ?

4. $11 \times 11 = ?$ $\frac{1}{11}$ of 121 = ? $\frac{3}{11}$ of 121 = ? $\frac{7}{11}$ of 121 = ?

5. What part of 121 is 11? What is the ratio of 11 to 121?

6. $12 \times 5 = ?$ $12 \times 6 = ?$ $12 \times 8 = ?$ $12 \times 12 = ?$
$\frac{1}{12}$ of 144 = ? $\frac{2}{12}$ of 144 = ? $\frac{3}{12}$ of 144 = ? $\frac{4}{12}$ of 144 = ?
$\frac{6}{12}$ of 144 = ? $144 \div 12 = ?$ How many 12's in 144?

7. $9\overline{)108}$ $12\overline{)144}$ $11\overline{)110}$ $10\overline{)120}$ $12\overline{)108}$ $10\overline{)100}$

$10\overline{)110}$ $12\overline{)120}$ $12\overline{)132}$ $11\overline{)132}$ $11\overline{)121}$ $12\overline{)144}$

8. Multiply 9, 12, 11, 10, 8, 5, 3, 7, 6, 4, by 9 and add 4; by 10 and add 2; by 11 and add 3; by 12 and add 5.

9. Find the products:

$42 \times 11 = ?$ $13 \times 12 = ?$ $18 \times 12 = ?$ $76 \times 11 = ?$

$19 \times 12 = ?$ $98 \times 12 = ?$ $99 \times 12 = ?$ $65 \times 12 = ?$

$5 \times 3 \times 4 = ?$ $6 \times 4 \times 5 = ?$ $6 \times 7 \times 2 = ?$ $8 \times 10 \times 5 = ?$

$11 \times 3 \times 12 = ?$ $6 \times 15 \times 4 = ?$ $3 \times 17 \times 5 = ?$ $8 \times 5 \times 13 = ?$

$7 \times 6 \times 15 = ?$ $11 \times 7 \times 6 = ?$ $12 \times 5 \times 4 = ?$ $3 \times 11 \times 5 = ?$

ROMAN NUMERALS

On the clock we found Roman figures or numerals. Our more common figures came from Arabia and India, lands even farther away than Rome in Italy.

I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1000

I = one	= 1	XX	= twenty	=	20
II = two	= 2	XXI	= twenty-one	=	21
III = three	= 3	XXX	= thirty	=	30
IV = four	= 4	L	= fifty	=	50
V = five	= 5	XL	= forty	=	40
VI = six	= 6	LX	= sixty	=	60
VII = seven	= 7	C	= one hundred	=	100
VIII = eight	= 8	XC	= ninety	=	90
IX = nine	= 9	CX	= one hundred ten	=	110
X = ten	= 10	CC	= two hundred	=	200
XI = eleven	= 11	D	= five hundred	=	500
XIX = nineteen	= 19	M	= one thousand	=	1000

On the clock we find IIII instead of IV for four.

1. Write in Roman numerals 45, 70, 225, 800.

2. What is the ratio of C to L? of D to C? of XVIII to IX? of XVI to XII? of XL to XX? of M to D?

SIMPLE CANCELLATION

3. Willie bought 8 lb. of brown sugar for his mother at $4\frac{1}{2}¢$ a pound. What was the cost?

$4\frac{1}{2}¢ = \frac{9}{2}¢$. $9¢ \times 4 = 36¢ = \frac{9}{2}¢ \times 8$. $\frac{9}{2}¢ \times 8 = 9¢ \times 4$, for $\frac{1}{2} \times 8 = 1 \times 4$.

4. Mary bought 12 paper dolls at $1\frac{1}{3}¢$ each. What did she pay? $1\frac{1}{3}¢ = \frac{4}{3}¢$. $12 \times \frac{4}{3}¢ = 4 \times 4¢$, for $12 \times \frac{1}{3} = 4 \times 1$. Explain in full the processes partly omitted in **3** and **4**.

GENERAL REVIEW

1. Give the multiplication tables.

2. Give the tables of weights and measures.

3. Explain eighth, quarter, half, and whole notes in music.

4. What is an octagon?

5. Give two fractions that equal three ninths.

6. Count to one hundred by each number from two to twelve beginning at 1: at 2: at 3.

7. What is 15×3? 18×2? 8×11? 35×2? 20×3? 50×2? 25×4? 3×33? 12×6? 200×5?

8. Mary gave \$3.20 to her sister, who had \$1.50 before. How much money did her sister then have?

9. When Annie put the water on the stove it was 52° warm. In 4 minutes it was boiling. How many degrees did the water rise in temperature each minute? Do you think the fire was very hot or not?

10. John's father borrowed \$100 and agreed to pay the money back in 100 days. How many months was that?

11. Tell the exact number of days in each month.

12. Willie's house is number 850 on Lake Street, but Charlie's is 225. How many numbers are they apart? If Willie lives on the east side of the street, on which side do you think Charlie lives?

13. What is the ratio of a ton of coal to four hods of coal that weigh twenty-five pounds each?

14. What is the ratio of 3 yd. to 2 ft.? to 12 ft.? to 36 ft.?

15. Name some numbers that have the ratio of 10 to 3, 7, 9, 10, 50, 8, 100?

16. Susan bought a dozen eggs at $2\frac{1}{2}$¢ each. What was the cost? Explain the way to get the answer.

DOLLARS AND CENTS

1. Six boys had in all $3.30. They divided the money equally. How much had each? We find this by

DIVISION

$$\begin{array}{r} 6)\$3.30 \\ \$.55 \end{array}$$

6 is found in 3 (hundreds) 0 times.
6 is found in 33 (tens) 5 times and 3 tens over.
6 is found in 30 (units) 5 times.

2. Eight girls had in all $3.60. They went to a store and saw there some dolls at 50¢ each. The clerk told them that he could sell eight dolls at a little lower price each, and gave them the dolls for their money. What price did they pay for each doll?

$$\begin{array}{r} 8)\$3.60 \\ \$.45 \end{array}$$

8 is found in 3 (hundreds) 0 times.
8 is found in 36 (tens) 4 times and 4 tens over.
8 is found in 40 units 5 times.

Tell number stories, using the following facts:

3. $6. and 5 boys buying books : or — : or —.

4. $2.40 and 12 girls selling violets : or — : or —.

5. $7)\underline{\$4.27}$ 6. $9)\underline{\$5.49}$ 7. $11)\underline{\$13.20}$ 8. $9)\underline{\$3.96}$

REVIEW WRITE

9. Add 30¢, $4., $1.25, $10., 47¢, and a half dollar.

10. How many inches are there in $7\frac{1}{2}$ ft.?

11. John sold four dozen eggs at 2¢ each egg. What amount did he receive?

12. Mr. Clark's horse weighed $\frac{1}{2}$ ton. How many pounds did he weigh?

13. It is April 1. Mary's baby sister is 1 mo. and 8 days old. What day was the baby's birthday?

MONEY

1. If a cake cost 8¢, then $\frac{1}{4}$ of it will cost — cents.

2. Half a dollar and a quarter of a dollar make — quarters of a dollar.

3. If I pay 16¢ for 8 apples, half that number of apples will cost — cents.

4. 5¢ is $\frac{1}{2}$ of — cents. 3¢ is $\frac{1}{2}$ of — cents.

5. 2¢ is $\frac{1}{4}$ of — cents. 1¢ is $\frac{1}{4}$ of — cents.

6. If 6 yards of silk cost $18, 1 yard will cost $—.

7. If 9 yards of silk cost $18, $\frac{1}{2}$ yard will cost $—.

8. At 12¢ a qt. what will be the cost of 8 qt. of berries?

9. If a tub of butter costs $11, how many tubs can be bought for $77?

10. Willie had 6 dimes and 2 nickels. How many cents did he have?

11. If berries were 8¢ a quart, how many quarts could you buy with half a dollar? After paying for the berries, how many cents would you have left?

12. Arthur had 3 cents, 2 nickels, and a quarter of a dollar. After paying for 6 five-cent car fares, how many cents did he have left?

13. In 1 day a milkman sold 50 gallons of milk at 20¢ a gallon and 10 gallons of cream at $1. a gallon. How much money in all did he receive?

14. In 13 what price per quart did the milkman receive for his milk? What price per quart for his cream? What prices would you expect to pay where you live?

15. Bertha picked 47 quarts of plums, and her brother Thomas picked 18 more than 5 times as many. At 10¢ a quart, how much money were all the plums worth?

UNITED STATES MONEY

5 cents (¢) make 1 nickel (n.)
10 cents make one dime (d.)
25 cents make a quarter dollar
10 dimes make 1 dollar ($)
50 cents make a half dollar
100 cents make 1 dollar.

1. How many cents make half a dime?
2. What part of a dollar is a dime?
3. 6 dimes make what part of a dollar?
4. What is the name of the smallest coin we use?
5. How many cents are there in 3 dimes and a nickel?
6. What will six pictures cost at $12 each?
7. If a quart of chestnuts is worth 10¢, what will a peck cost?
8. $\frac{1}{5}$ of my money is 4¢. How many cents have I?
9. Louis made 19¢ by selling papers. He spent 7¢. How many cents did he have left?
10. I paid for an overcoat with three 10-dollar bills; and received 8 1-dollar bills as change. What was the price of the overcoat?
11. If 3 qt. of vinegar cost 33¢, what is the price of 1 qt.? What will 7 qt. cost at the same price?
12. Louise bought 10 yards of braid at 7¢ a yard, and gave the clerk a fifty-cent piece and a quarter. What change should the clerk give her?
13. If 7 dozen apples cost 84¢, what will 2 dozen cost?
14. At 5¢ apiece how many cents will 7 oranges cost?
15. James bought 4 oranges at 4¢ each. What change should he get from a quarter which he gave in paymen

TIME MEASURE

30 days are usually counted as 1 month.

1 mo. = 30 days.

365 days are usually counted as 1 year.

1 yr. = 365 days.

There are $52\frac{1}{7}$ weeks in 1 year.

1. How many days are there in 3 yr.? in 2 yr. 3 mo.?

2. How many minutes are there in 4 hr.? in 2 hr. and a half?

3. How many seconds are there in 3 min.? in 8 min.?

4. How many days are there in 4 wk.? in 8 wk.?

5. How many seconds are there in half an hour?

6. George went on a visit to his cousin Charles, and stayed six weeks. How many days did he stay? If he ate three meals every day, how many meals did he eat while there?

7. Charles could run a mile in eight minutes, and George a thousand yards in the same time. Which could run faster?

8. If Mary reads ten pages every day, how many pages does she read in a month? in a year?

9. If a book has 400 pages in it, and you read 10 pages every day, in how many days can you read the book?

10. John read 12 books in one year. At that rate how many books can he read in 104 weeks?

11. In 100 days are how many months? how many weeks?

TIME MEASURE

60 seconds make 1 minute

1 min. = 60 secs.

60 minutes make 1 hour

1 hr. = 60 min.

24 hours (hr.) make 1 day

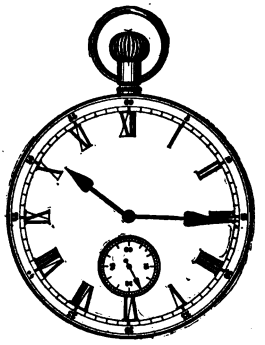
1 day = 24 hrs.

7 days make 1 week (wk.)

1 wk. = 7 days

12 months (mo.) make 1 year (yr.)

1 yr. = 12 mo.



1. What day of the week is to-day?

2. Name the days of the week in their order.

3. Read the time on this watch face in hours, minutes, and seconds.

4. At what hour does school begin in the morning?

5. How many hours do we spend in school in the afternoon? in the forenoon? during the day?

6. What time is it at noon? Where are the clock hands then? What time is it at midnight?

7. How many months are there in 2 years?

8. How many seconds are there in 2 hr. 5 min.?

9. Give the months in their order.

10. How many months are there in a quarter of a year?

11. How many months of vacation from school do we have every year?

12. Name the school vacation months.

13. What other vacations do we have?

TIME

1. In which month does New Year's Day come?

2. In which month does Washington's Birthday come?

3. In which month does your birthday come?

4. Lincoln's Birthday comes in the month of ——.

5. Memorial Day comes in the month of ——.

6. Independence Day is ——.

7. Thanksgiving Day is usually the last Thursday in ——.

8. Christmas Day is the 25th of ——.

9. A man built a stone fence in 48 days. How many weeks did it take him to build the fence? Six working days are usually counted as one week.

10. 4 bricklayers laid the bricks for a house in 36 days. What part of the brick work did they do in 1 week? in 2 weeks? in 3 weeks?

11. A boy picked 3 pk. of cherries in one day. At that rate how long would it have taken him to pick 3 bu.?

12. Do you have Labor Day or Fast Day in your State? When? Do you celebrate Arbor Day?

13. If January 1 comes on Sunday, how many Sundays will there be in the year? In a year are how many weeks and days?

14. If in one year Sunday comes January 1, the next year what week-day will be January 1?

15. What part of 98 days is a fortnight?

REVIEW

1.

$8+\ 3+4+1=?$	$7+6+3-6=?$
$5+\ 5+5-4=?$	$6+7-2=?$
$3+\ 4+1+2=?$	$9+1+5-3=?$
$4+\ 4-2-9=?$	$12-6-3=?$
$26-10-5-1=?$	$18+2+4-1=?$

2. How many 2's are in 22? How many 11's in 22?

$\frac{1}{11}$ of $22=?$	$\frac{2}{11}$ of $22=?$	$\frac{3}{11}$ of $22=?$
$\frac{5}{11}$ of $22=?$	$\frac{8}{11}$ of $22=?$	$\frac{10}{11}$ of $22=?$
$\frac{11}{11}$ of $22=?$	$\frac{1}{2}$ of $22=?$	$\frac{2}{2}$ of $22=?$

3. $9)\underline{12}\quad 8)\underline{14}\quad 3)\underline{17}\quad 5)\underline{21}\quad 6)\underline{16}\quad 4)\underline{13}\quad 6)\underline{21}\quad 3)\underline{20}$

$2)\underline{24}\quad 2)\underline{22}\quad 8)\underline{24}\quad 6)\underline{24}\quad 3)\underline{24}\quad 4)\underline{24}\quad 11)\underline{22}\quad 12)\underline{24}$

4.	**5.**	**6.**	**7.**
$24=8\times ?$	$24=6\times ?$	$24=4\times ?$	$24=3\times ?$
$24=2\times ?$	$24=12\times ?$	$22=11\times ?$	$22=2\times ?$
$24=?\times 3$	$24=?\times 6$	$24=?\times 8$	$22=?\times 2$
$24=?\times 12$	$24=?\times 4$	$6\times ?=24$	$8\times ?=24$
$11\times ?=22$	$3\times ?=24$	$12\times ?=24$	$4\times ?=24$
$2\times ?=22$	$2\times ?=24$	$7+3-5=?$	$8+5-4=?$

8. $2+\ 4-1=?\qquad 16-6+5=?\qquad 20-12-1=?$

9. $10-\ 4-2=?\qquad 8-5+3=?\qquad 6-2+1=?$

10. $20-10-4=?\qquad 12-6+2=?\qquad 18-9-4=?$

11. Add:

18	16	21	13	17	19	19	17	18
14	15	10	11	14	12	14	15	17

12. Add:

\$4	3 min.	5 yd.	4 ft.	9 in.
\$6	2 min.	3 yd.	7 ft.	3 in.
\$6	5 min.	5 yd.	8 ft.	2 in.

FRACTIONS AND RATIOS

1. How many 9's are there in 108?

2. How many 12's are there in 108?

3. $\frac{1}{9}$ of 108 = ? $\frac{1}{12}$ of 108 = ? $\frac{2}{9}$ of 108 = ?
$\frac{4}{9}$ of 108 = ? $\frac{6}{9}$ of 108 = ? $\frac{2}{12}$ of 108 = ?
$\frac{3}{12}$ of 108 = ? $\frac{5}{12}$ of 108 = ? $\frac{7}{12}$ of 108 = ?

4. What is the ratio of 12 to 108? of 9 to 108?

$108 \div 12 = ?$ $108 \div 9 = ?$

5. $11 \times 8 = ?$ $8 \times 11 = ?$ $11 \times 9 = ?$ $9 \times 11 = ?$
$99 \div 11 = ?$

6. How many 11's are there in 99? $\frac{1}{11}$ of 99 = ? $\frac{2}{11}$ of 99 = ?

7. $10 \times 7 = ?$ $10 \times 9 = ?$ $10 \times 10 = ?$ $10 \times 11 = ?$
$10 \times 12 = ?$ $9 \times 10 = ?$ $11 \times 10 = ?$ $12 \times 10 = ?$
$\frac{1}{10}$ of 110 = ? $\frac{1}{11}$ of 110 = ? $\frac{1}{10}$ of 120 = ?
$\frac{1}{12}$ of 120 = ? $\frac{2}{10}$ of 120 = ? $\frac{2}{11}$ of 110 = ?
$\frac{2}{12}$ of 120 = ? $\frac{7}{12}$ of 120 = ? $\frac{3}{20}$ of 120 = ?

8. How many 10's are there in 110? What is the ratio of 110 to 10? of 10 to 110?

9. How many 11's are there in 110? What is the ratio of 110 to 11? of 11 to 110?

10. How many 12's are there in 120? What is the ratio of 120 to 12? of 12 to 120?

11. How many 10's are there in 120? What is the ratio of 120 to 10? of 10 to 120?

12. What is the ratio of a dollar to a dime? of a dime to a dollar?

13. What is the ratio of a dollar to a half dollar? to a quarter dollar?

GENERAL REVIEW

1. $\frac{2}{11}$ of 11 = ? $\frac{5}{11}$ of 11 = ? $\frac{8}{11}$ of 11 = ?

2. $\frac{2}{12}$ of 12 = ? $\frac{6}{12}$ of 12 = ? $\frac{1}{2}$ of 12 = ?

3. What part is 2 of 6, 10, 16, 18, 20, 4, 8, 12, 14?

4. What part is 3 of 6, 12, 18, 15, 9?

5. What part is 4 of 16, 12, 8, 20?

6. What part is 5 of 10, 15, 20?

7. What part of 18 is 6? of 20 is 10? of 18 is 9? of 14 is 7? of 12 is 6?

8. What is the number of 2's in 4, 20, 16, 14, 8, 10, 12, 18, 6?

9. How many 3's are there in 9? 6? 15? 12? 18?

10. How many 4's are there in 20? 4? 8? 12? 16?

11. What is the number of 5's in 20, 10, 5, 15?

12. How many 6's are there in 12? 18? 24? 30?

13. How many 7's are there in 14? 9's in 18? 10's in 20? 12's in 72?

14. $\frac{1}{3}$ of \$21 = ? $\frac{2}{3}$ of \$21 = ? $\frac{1}{7}$ of 14¢ = ? $\frac{2}{7}$ of 14¢ = ?

15. $\frac{3}{7}$ of 14¢ = ? $\frac{4}{7}$ of 14¢ = ? $\frac{5}{7}$ of 14¢ = ? $\frac{6}{7}$ of 14¢ = ?

16. Add:

4	2	7	3	5	1	8	8	9
6	8	1	6	4	4	2	8	2
1	2	1	2	3	5	8	3	9
9	1	4	5	9	3	5	3	5
2	9	3	5	1	7	1	7	8
7	9	8	5	9	3	9	7	7

SUMS

1. Find the sum of four hundred fifty-one, two thousand eight hundred six, four thousand ninety-three, six thousand two hundred seventy.

2. Find the sum of seven hundred sixty-three, two thousand seventeen, five thousand four hundred fifty, six thousand three hundred nine.

3. Find the sum of six thousand four hundred sixty-three, one hundred ninety-six, forty-seven, two thousand three hundred eighty.

4. Find the sum of two hundred forty-seven, two thousand nine hundred eighteen, ninety-four, four thousand six hundred forty-seven.

5. Find the sum of nine thousand one hundred forty-five, four hundred thirty-six, two thousand one hundred seventy-two, nine.

6. Find the sum of three thousand three hundred thirty, four hundred eight, two thousand one hundred ninety-seven, six thousand four hundred five.

7. Find the sum of seven thousand eighteen, eight hundred ninety, six thousand seven hundred fifty-two, five thousand two hundred seventy-four.

8. Find the sum of seventeen, nine thousand eight hundred sixty, one thousand twenty-four, eight thousand six hundred five.

9.	10.	11.	12.	13.	14.
2333	91600	71461	2222	78912	13456
4567	7149	9147	333	3456	987
8912	86004	90061	44444	78	29
3456	19130	4713	5555	98765	98613

REVIEW QUESTIONS

1. Harry attended school on 17 days in January, and had to walk 3 miles each day to do so. How many miles did he walk to attend school that January?

2. Annie walked a mile to school every school day and a mile home again. How many miles did she thus walk in a week of 5 school days?

3. A railway train ran for 4 hours at the rate of 27 miles an hour? What distance did it run?

4. George takes 2350 steps to a mile. How many steps will he take in walking 3 miles?

5. There are 8 boys in Will's class, including Will himself. Each boy has 28 teeth. How many teeth have all?

6. A spider has 8 legs and a fly has 6. How many legs have 6 spiders and 8 flies?

7. A mail-carrier drove every working day from A to B, 4 miles; from B to C, 3 miles; from C to D, 5 miles; and from D back to A, 5 miles. How many miles did he drive every week?

8. James walked 8 miles a day on 25 days in January, on 23 days in February, and on 26 days in March. How many miles in all did he walk in the three months?

9. How many feet are there in 5 yards? in 7 yards? in 9 yards? in 12 yards? in 20 yards? in 387 yards?

10. If a man walks 22 miles in a day, how many miles will he walk in 10 days? in 20 days?

11. If a horse eats 6 pecks of oats in a week, how many pecks will he eat in 7 weeks? in 12 weeks?

12. If a yard of cloth cost $6, how much will 8 yards cost? 10 yards?

REVIEW QUESTIONS

1. If 5 men build a wall in 8 days, how many men can build it in one day?

2. If 5 men build a wall in 12 days, in how many days can one man build it?

3. A train moves 8 times as fast as a man who walks 7 feet a second; how many feet does the train pass over in a second?

4. How many inches are there in 7 feet? in 8 feet? in 10 feet? in 12 feet? in 100 feet?

5. Five pipes, all the same in size, empty a cistern in 10 minutes. In how many minutes will one such pipe empty it?

6. A cistern is emptied by 5 pipes, all the same in size, in 16 minutes. How many such pipes will empty the cistern in one minute?

7. If a box weighs 3 pounds, what is the weight of 32 such boxes?

8. If a man works 7 hours a day, how many hours does he work in 32 days?

9. James is 9 years old, and his father is four times as old, lacking a year. How old is his father?

10. In a certain schoolhouse there are 29 windows; in each window there are 4 rows of panes with 3 panes in each row. How many panes are there in all the windows?

11. In a field of corn there were 67 rows with 78 hills in each row. If the hills yielded, on an average, 7 ears to a hill, how many ears did the field produce?

12. Find the number of men in an army consisting of 7 regiments averaging 873 men each.

SUBTRACTION

1. From 45 subtract 29.

$45 = 40 + 5$
$29 = 20 + 9$

$45 = 30 + 15$
$29 = 20 + 9$
$16 = 10 + 6$

We cannot take 9 from 5. However, we can take one ten from forty, for $40 = 30 + 10$. $10 + 5 = 15$. 15 less 9 are 6. Then we take the two tens in twenty from the three tens in thirty. The remainder is one ten. $10 + 6 = 16$, the difference between 45 and 29.

2. From 74 take 37.

$74 = 70 + 4$
$37 = 30 + 7$

$74 = 60 + 14$
$37 = 30 + 7$
$37 = 30 + 7$

3. A farmer had 84 sheep and lambs all together. There were 35 lambs. How many sheep had he?

4. A boy had 38 marbles. Of these, 19 marbles were new and perfect in shape. How many of his marbles were old?

5. Find the remainders:

42	55	52	63	98	84	67	85	95	88	79	36
27	29	36	38	75	52	54	38	36	9	19	28
85	91	82	73	57	32	41	54	66	97	86	75
38	72	81	14	48	13	29	39	46	58	27	25

6. Make up questions like **3** and **4**, using the numbers in **5**, and answer the questions orally.

7. A man who earned $4 every day when he worked was unable to work 175 days, including Sundays and holidays, one year. How many days did he work? How much money did he earn?

ROMAN NOTATION

This notation uses seven capital letters: I, V, X, L, C, D, M.

I = 1; V = 5; X = 10; L = 50; C = 100; D = 500; M = 1000.

I = 1	XVI = 16	LXXX = 80
II = 2	XVII = 17	LXXXI = 81
III = 3	XIX = 19	XC = 90
IV = 4	XX = 20	XCI = 91
V = 5	XXI = 21	CI = 101
VI = 6	XXX = 30	CC = 200
VII = 7	XXXI = 31	CCC = 300
VIII = 8	XL = 40	CCCC = 400
IX = 9	XLI = 41	D = 500
X = 10	L = 50	DC = 600
XI = 11	LI = 51	DCC = 700
XII = 12	LX = 60	DCCC = 800
XIII = 13	LXI = 61	DCCCC = 900
XIV = 14	LXX = 70	M = 1000
XV = 15	LXXI = 71	MM = 2000

Compare these two ways of writing numbers and give some reasons why the Roman notation is easier and some reasons why it is harder than our common notation.

PRINCIPLES

Repeating a letter repeats its value:

III, 3; XXX, 30; CC, 200; CCCXXII, 322.

When a letter is placed before one of greater value, the value of the less number is subtracted from the value of the greater; as IV = 5 − 1 = 4; XL = 50 − 10 = 40.

XIX = 10 + 10 − 1 = 19; XXIV = 10 + 10 + 5 − 1 = 24.

When a letter is placed after one of greater value, the value of the less is added to the value of the greater; as

VI = 5 + 1 = 6; MC = 1000 + 100 = 1100.

EXERCISES

IV = ?	DXI = ?	LXXI = ?
XXIII = ?	MDXXI = ?	XLIX = ?
XIX = ?	MCCCCXCII = ?	XXVIII = ?
LIV = ?	MV = ?	MIX = ?
XXXV = ?	DXIV = ?	MDXI = ?
D = ?	CDLXX = ?	L = ?
DLV = ?	CMX = ?	LXXXIV = ?
DC = ?	CCCI = ?	MDCCCLXI = ?
DCCC = ?	XCIX = ?	MDCCCC = ?
MMM = ?	MMCC = ?	MDCCCXCIX = ?
LXXIV = ?	VM = ?	MCM = ?
XVIII = ?	CCXCV = ?	MCMII = ?
XCIX = ?	MCD = ?	MCMIX = ?
CCXX = ?	DXI = ?	MCMXXX = ?
XLVII = ?	MDC = ?	MM = ?

19 = ?	42 = ?	200 = ?	1200 = ?	75 = ?
31 = ?	99 = ?	304 = ?	1419 = ?	175 = ?
49 = ?	54 = ?	520 = ?	1641 = ?	1750 = ?
75 = ?	71 = ?	411 = ?	1861 = ?	555 = ?
38 = ?	86 = ?	900 = ?	1900 = ?	1776 = ?

Rome is a great city in Italy, a land five thousand miles away across the great Atlantic Ocean. It was built by very brave, hard-working people more than two thousand seven hundred years ago.

Where have you seen Roman figures used?

SUBTRACTION

1. From 232 take 141.

$232 = 200 + 30 + 2$
$141 = 100 + 40 + 1$

$232 = 190 + 40 + 2$
$141 = 100 + 40 + 1$
$91 = 90 + 0 + 1$

We cannot take 4 tens from 3 tens. $200 = 190 + 10$. $10 + 30 = 40$. Hence we say $2 - 1 = 1$, $40 - 40 = 0$, $190 - 100 = 90$, $90 + 0 + 1 = 91$, which is the remainder or difference.

2. From 232 take 143.

$232 = 200 + 30 + 2$
$143 = 100 + 40 + 3$

$232 = 200 + 20 + 12$
$143 = 100 + 40 + 3$

$232 = 180 + 40 + 12$
$143 = 100 + 40 + 3$
$89 = 80 + 0 + 9$

We cannot take 3 units from 4 units. And we cannot take 4 tens from 3 tens. If we take 1 ten from 3 tens, we will have to take 2 tens from 200. Hence we have 12 from the 2 units given and the 10 taken from 30. 12 less $3 = 9$. And we have 40 from the 20 left when we took 10 from 30 and from the 20 taken from the 20 tens in 200. 40 less $40 = 0$. Last, we have 180, the difference between 200 and the 20 given to 20 to make 40; and from 180 we take 100, leaving 80. $80 + 0 + 9 = 89$, the difference between 232 and 143.

3. From 2453 take 1541.

$2453 = 2000 + 400 + 50 + 3$
$1541 = 1000 + 500 + 40 + 1$

$2453 = 1000 + 1400 + 50 + 3$
$1541 = 1000 + 500 + 40 + 1$
$912 = 0 + 900 + 10 + 2$

Comparing these, we see that in each case except one the subtrahend is less than the minuend. But 400 is less than 500. Hence we take 1 thousand from 2 thousands. $1000 + 400 = 1400$.

SUBTRACTION

1. From 2456 take 1587.

$$2456 = 2000 + 400 + 50 + 6 = 1000 + 1300 + 140 + 16$$
$$1587 = 1000 + 500 + 80 + 7 = 1000 + 500 + 80 + 7$$
$$869 = 0 + 800 + 60 + 9$$

Or we may represent in this form the processes of taking:

$$\begin{array}{cccc} & 13 & 14 & \\ 1 & \not{3} & \not{4} & 16 \\ \not{2} & \not{4} & \not{5} & \not{6} \\ 1 & 5 & 8 & 7 \\ \hline 8 & 6 & 9 & \end{array}$$

After we have practiced a good many subtractions, we find it much easier to carry all the "takings" of tens and hundreds and thousands in the memory, and not to write them upon paper at any time.

Subtract:

2.	3.	4.	5.	6.	7.
142	253	111	194	185	643
93	96	22	95	106	554

8.	9.	10.	11.	12.	13.
1894	1847	1853	5236	4116	3829
1886	1739	967	4348	3208	3759

14. From 308 take 209.

$$308 = 300 + 8 = 290 + 18$$
$$209 = 200 + 9 = 200 + 9$$
$$99 = 90 + 9$$

We cannot take 9 from 8; and we cannot take 1 ten from no ten. But we can take 1 ten from 30 tens, leaving 29 tens.

15. Subtract 1605 from 2503; 3406 from 4401; 1989 from 5000.

SUBTRACTION

	A	B	C	D	E	F	G	H	I	J
1.	25	44	76	93	58	426	748	269	371	914
	13	31	25	71	24	104	126	147	240	813
2.	320	506	953	758	460	309	865	271	750	618
	141	208	670	270	107	256	93	148	391	88
3.	140	700	648	310	200	705	918	444	100	208
	54	107	97	78	199	507	819	155	17	198

	A	B	C	D	E	F	G	H
4.	2760	4705	7004	1280	2047	3042	8910	4760
	819	3250	1252	417	1919	2024	3204	1076
5.	6374	3003	6856	4004	3626	9271	6119	7208
	4485	303	1269	440	1836	790	5911	2975

ADDITION

K	L	M	N	O	P	Q	R	S	T
423	865	721	233	654	329	103	406	598	207
351	642	342	912	317	485	62	9	147	609
486	317	809	341	862	17	708	470	594	423
510	423	417	190	194	934	390	58	46	48
136	186	153	617	706	460	47	103	810	276

6. Mary had three dollars sixty-five cents. Then her aunt gave her two dollars fifty cents, and her father one dollar. How much money did she then have in all?

DIVISION

1. Divide 7212 by 7, with fractional quotient, if necessary.

$$7\overline{)7212}$$
$$1030\tfrac{2}{7}$$

Proof:

1030		Quotient
× 7		Divisor
7210		
+ 2		Remainder
7212		Dividend

7 is contained in 7 thousands 1 (thousand) times. We write 1 in thousands' place in the quotient. 7 is not contained in 2 (hundreds). We write zero in hundreds' place, and add the 2 hundreds, which equal 20 tens, to the 1 ten. 7 is contained in 21 tens, 3 tens times. We write 3 in tens' place. 7 is not contained in 2 units. We write zero in units' place. 2 is written over the divisor, 7, with a line between the two figures, to show that the 2 is still to be divided by 7.

2. Divide 5232 by 12.

$$12\overline{)5232}$$
$$436$$

Proof:

$$\begin{array}{r} 436 \\ \times\ 12 \\ \hline 5232 \end{array}$$

12 is contained in 52 4 times ($12 \times 4 = 48$) with 4 over. The 52 is the sign not of 52 units, but of 52 hundreds. The 4 over stands for 4 hundreds. 12 is contained in 43 3 times ($12 \times 3 = 36$) with 7 over. The 43 is for 43 tens, and the 7 over is for 7 tens. 12 is contained in 72 6 times ($12 \times 6 = 72$).

3. Divide 6336 by 11, 3, 8, 4, 6, and 12.

4. Divide 5084 by 9, 12, 3, 4, 8, and 6.

5. Divide 4679 by 2, 4, 8, 3, 6, and 12.

6. Divide 9214 by 4, 5, 11, 9, 7, and 10.

DIVISION

Read and answer:

A.	$40 \div 5 = ?$	$5)\underline{46}$	$\frac{48}{5} = ?$	$7)\underline{63}$	$72 \div 6 = ?$
B.	$12 \div 4 = ?$	$\frac{11}{4} = ?$	$4)\underline{13}$	$9)\underline{72}$	$48 \div 8 = ?$
C.	$\frac{67}{3} = ?$	$\frac{85}{7} = ?$	$\frac{20}{5} = ?$	$8)\underline{80}$	$36 \div 6 = ?$
D.	$\frac{24}{4} = ?$	$\frac{48}{6} = ?$	$\frac{84}{7} = ?$	$\frac{50}{5} = ?$	$108 \div 8 = ?$
E.	$\frac{18}{9} = ?$	$\frac{56}{8} = ?$	$\frac{33}{11} = ?$	$\frac{45}{11} = ?$	$18 \div 9 = ?$
F.	$12)\underline{72}$	$9)\underline{118}$	$6)\underline{36}$	$7)\underline{49}$	$49 \div 6 = ?$
G.	$\frac{72}{4} = ?$	$\frac{108}{9} = ?$	$\frac{36}{6} = ?$	$\frac{49}{7} = ?$	$56 \div 8 = ?$

WRITE

Copy and answer:

1.	$6)\underline{41019}$	9. $8100406 \div 6 = ?$	17. $4)\underline{84920} = ?$
2.	$8)\underline{704653}$	10. $100610067 \div 8 = ?$	18. $5)\underline{256075} = ?$
3.	$7)\underline{378697}$	11. $123456789 \div 9 = ?$	19. $5)\underline{405620} = ?$
4.	$2)\underline{48206}$	12. $200000000 \div 7 = ?$	20. $6)\underline{612978} = ?$
5.	$9146291 \div 2 = ?$	13. $2)\underline{60428} = ?$	21. $6)\underline{960726} = ?$
6.	$714632 \div 3 = ?$	14. $3)\underline{39630} = ?$	22. $7)\underline{49714} = ?$
7.	$1234610 \div 4 = ?$	15. $4)\underline{12804} = ?$	23. $7)\underline{364847} = ?$
8.	$7000000 \div 5 = ?$	16. $3)\underline{120936} = ?$	24. $5)\underline{465845} = ?$

25. What is the ratio of seventy million people to a family of fifteen persons? of five persons?

MULTIPLICATION

1. Multiply 73 by 45.

	73	multiplicand
	45	multiplier
$5 \times 73 =$	365	first partial product
$40 \times 73 =$	292	second partial product
	3285	total product

Multiplying 73 units by 5 gives as a product, 365 units. Multiplying 73 by 4 tens gives as a product, 292 tens = 2920 units. 292 tens, or 2920 units, plus 365 units = 3285 units. The right-hand figure of the product, 365, is placed under the 5 of the multiplier. The product, 292, obtained by multiplying by 4 (tens), is so placed that its right-hand figure, 2, comes under the 6 of the multiplier. To show that we are adding units, tens, hundreds, thousands, together, we write them in the same columns, as in addition.

2. Multiply 175 by 24, and 2763 by 58.

175		2763	multiplicand
24		58	multiplier
$4 \times 175 =$ 700	$8 \times 2763 =$	22104	partial product
$20 \times 175 =$ 350	$50 \times 2763 =$	13815	partial product
$24 \times 175 =$ 4200	$58 \times 2763 =$	160254	total product

To multiply by 10, annex a zero to the multiplicand; to multiply by 100, annex two zeros; to multiply by 1000, annex three ciphers.

3. $3{,}685 \times 10 = 36{,}850$ $\quad 7{,}000 \times 10 = 70{,}000$

4. $46{,}373 \times 100 = 4{,}637{,}300$ $\quad 7{,}000 \times 100 = 700{,}000$

5. $9 \times 1000 = 9{,}000$ $\quad 642 \times 1000 = 642{,}000$

MULTIPLICATION

Multiplicands	Multipliers
I 8509	(*a*) 45
II 7004	(*b*) 17
III 8020	(*c*) 63
IV 9867	(*d*) 98
V 7118	(*e*) 87

Multiply each of the multiplicands by each of the multipliers. Why will there be 25 different products?

1. Albert takes 2460 steps to a mile. How many steps will he take in walking 3 miles a day for 5 days?

2. An acre of land contains 4840 square yards. How many square yards are there in 10 acres? in 27 acres? in 50 acres?

3. Find the cost of 27 tons of steel at $39 a ton.

4. At 27 bushels of wheat to an acre, how many bushels would 36 acres yield?

5. A drover bought 37 head of cattle at $48 each. How much did he pay for them all?

6. How much money would be required to pay $500 each to 798 men?

7. How many days' work will 36 men do in 27 days?

8. Emma bought a doll for 25¢ and a doll's carriage for five times as much. How much did both doll and carriage cost?

9. A merchant bought 768 pounds of cheese at 7¢ a pound, 287 pounds of butter at 19¢ a pound, and 178 dozen eggs at 13¢ a dozen. Find the total cost.

10. A man had a chest of tea, which at first contained 87 pounds, but 29 pounds were taken out of it. How much was the rest of the tea worth at 63¢ a pound?

11. A man bought two farms, one containing 167 acres at $73 an acre, the other containing 79 acres at $87 an acre. How much did both farms cost him?

MULTIPLICATION

Multiply each multiplicand by each multiplier.

Why will there be 100 products?

Punctuate the multiplicands and the products so as to read the thousands correctly and quickly.

Multiplicands		Multipliers		Multiplicands		Multipliers	
I	36723	(*a*)	2	VI	60389	(*f*)	7
II	14576	(*b*)	3	VII	70895	(*g*)	8
III	100835	(*c*)	4	VIII	63809	(*h*)	9
IV	73809	(*d*)	5	IX	909009	(*i*)	11
V	356724	(*e*)	6	X	87632	(*j*)	12

DIVISION

Divide each dividend by each divisor.

Punctuate the dividends and the quotients so as to read the thousands correctly and quickly.

Dividends		Divisors		Dividends		Divisors	
A	355680	(*k*)	6	*F*	316169	(*p*)	5
B	39521	(*l*)	3	*G*	695201	(*q*)	7
C	118560	(*m*)	4	*H*	10824	(*r*)	8
D	711369	(*n*)	2	*I*	129888	(*s*)	11
E	750889	(*o*)	9	*J*	119064	(*t*)	12

1. What is the ratio of one hundred thousand persons to ten? Of one million to one thousand?

2. One city had 153629 people; another city had 9 times as many. How many had the second city?

3. A family used 49 lb. of coal a day. How many did they use in 7 days? From 1 T. how many pounds were left after 40 days?

GENERAL MULTIPLICATION TABLE

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8								
3	6	9	12								
4	8	12	16								
5					30			45			
6				30							72
7							56				
8						56	64				
9			36						90		
10								90.			
11										121	
12					72						144

1. On a sheet of paper mark off 144 half-inch squares. Copy very accurately the numbers here. Fill in each blank square by the multiple of the numbers at the head of the column and at the left end of the row. $4 \times 2 = 8$ and $2 \times 4 = 8$. $11 \times 11 = 121$ and $12 \times 12 = 144$.

2. Compare your results with the multiplication tables in this book.

3. On the blackboard make 144 two-inch squares and proceed as in 1.

4. Why are the numbers larger, the nearer they are to the lower right hand corner of the *table?*

GENERAL REVIEW

Addition:

1.	2.	3.
80476	34567	723
9007	8000	674
986147	691	1674
91067	470000	19006
486	109687	1916
4071	48001	936936
937	290	97979

Subtraction:

4.		5.	
a.	1135 − 780	*h.*	5367 − 5269
b.	4232 − 3121	*i.*	8700 − 199
c.	9256 − 135	*j.*	7505 − 6469
d.	1202 − 1158	*k.*	1811 − 799
e.	8634 − 7402	*l.*	9707 − 8609
f.	7672 − 7589	*m.*	4627 − 1565
g.	8738 − 7394	*n.*	2444 − 566

Multiplication:

6.	7.	8.	9.	10.	11.	12.
1423	8512	615	10342	735	45346	32682
45	216	135	96	99	67	234

Division:

13.	14.	15.	16.	17.
5)6895	6)96108	4)72604	8)7589328	12)980424

ANSWER AND PROVE THE ANSWERS

18. From three thousand four hundred nine take one thousand six hundred fifteen.

19. From two thousand seventy-eight take eight hundred nineteen.

20. From six thousand two hundred ninety-eight take three thousand eight hundred nine.

21. From eight thousand two hundred seventy-four take two thousand six hundred five.

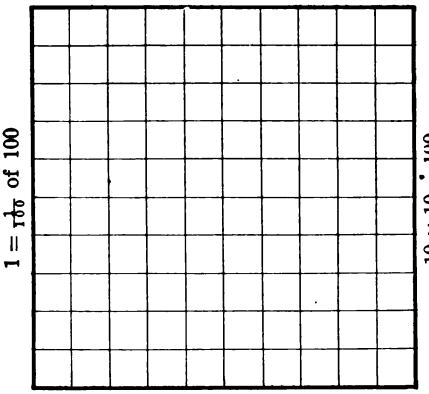
22. From three thousand eight hundred twenty take two thousand six hundred five.

HUNDRED AND HUNDREDTHS

We saw that $\frac{1}{2}$ of 2 things is 1, that $\frac{1}{5}$ of 5 things is 1, and that $\frac{1}{10}$ of 10 things is 1.

Every whole number suggests a fraction like it in name.

The number one hundred suggests a hundredth as a fraction.



1. Point out $\frac{1}{100}$, $\frac{1}{10}$, $\frac{3}{100}$, $\frac{3}{10}$, $\frac{25}{100}$, $\frac{33}{100}$, $\frac{50}{100}$.

2. Draw three squares like this and divide each of them into 100 squares.

a. Mark on one of them one half of the squares blue or red or black. How many are one half of one hundred?

b. On another square mark one fourth blue, another fourth red, and another fourth black. How many are one fourth of one hundred?

c. On the last square mark one third blue and another third red. How many are left white? If $3 \times 33 = 99$, then $\frac{1}{3}$ of $100 = ?$ Mark the last hundredth into thirds. What does this show? $33\frac{1}{3} \times 3 = ?$

PER CENTS

The fraction, a hundredth, is so important that we have another name for it, a **per cent.** This means *by the hundred.* 5 per cent is $\frac{5}{100}$. 10 per cent is $\frac{10}{100}$. $33\frac{1}{3}$ per cent is thirty-three and one third hundredths. Just as we have ¢ as the sign for cent and $ as the sign for dollar or 100¢, so also we have a sign for hundredths or per cents. This sign for hundredths is %, called **per cent.**

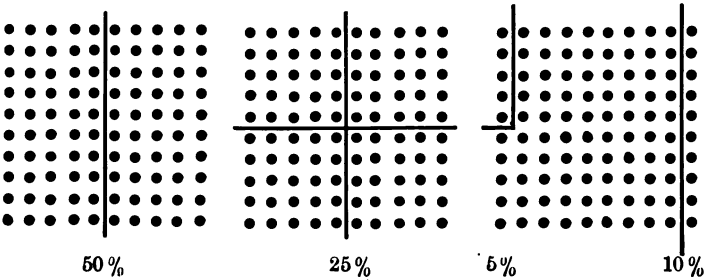
6% of $1 is $\frac{6}{100}$ of 100¢, or 6¢

50% of $1 is $\frac{50}{100}$ of 100¢, or 50¢

Per cents are especially used in dealing with money; for when one lends money to another, the lender usually asks the borrower not only to give him back after a time all his money, but also to pay him so many per cent for the use of the money. This payment is called **interest.** Also we pay the governments of our town or city and of our State every year so many per cent of the money value of our property. This payment is called a **tax.** It supports the police and schools and takes care of the streets or roads.

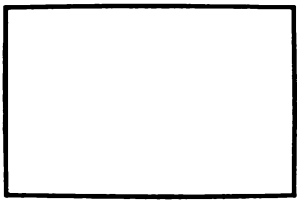
4% of $1000 is $\frac{4}{100}$ of $1000 $\quad \$\frac{1000}{100} = \$10 \quad \$10 \times 4 = \$40$

2% of $5000 is $\frac{2}{100}$ of $5000 $\quad \$\frac{5000}{100} = \$50 \quad \$50 \times 2 = \$100$



AREAS

We find the **areas** of rectangles in square measure by multiplying the lengths of the adjoining sides.

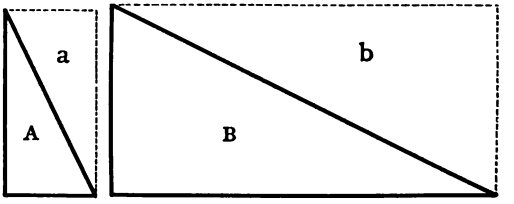


1. If the sides of this rectangle were 2 inches and 3 inches, its area would be 2 in. × 3 in. = 6 square inches = 6 sq. in.

2. If a mirror is 3 ft. × $4\frac{1}{2}$ ft. in size, its area is $13\frac{1}{2}$ sq. ft.

We find the areas of right-angled triangles by multiplying together the lengths of the sides which make the right angle and dividing their product by two.

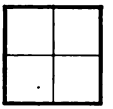
The dotted lines show the rectangle which the multiplication of the lengths of the two sides gives us.



3. Find the area of these triangles, *A* and *B*.

A. 1 sq. in. × $\frac{1}{2}$ = $\frac{1}{2}$ sq. in.
$\frac{1}{2}$ sq. in. = area of $A + a$.
$A = \frac{1}{2}(A \times a)$.
$\frac{1}{2}$ of $\frac{1}{2}$ sq. in. = $\frac{1}{4}$ sq. in.

B. 1 sq. in. × 2 = 2 sq. in.
2 sq. in. = area of $B + b$.
$B = \frac{1}{2}(B + b)$.
$\frac{1}{2}$ of 2 sq. in. = 1 sq. in.



Point out $\frac{1}{2}$ of $\frac{1}{2}$.

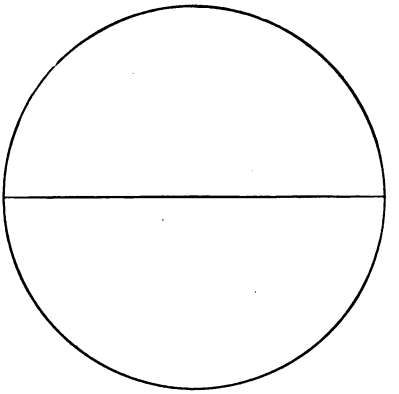
Find the areas of these triangles:

4. 2 miles by $6\frac{1}{2}$ miles.

5. 3 yds. by $9\frac{1}{3}$ yds.

CIRCUMFERENCES

A circle may be drawn on the blackboard by making a loose knot in a string and setting the knot around the crayon. Then if one holds the free end of the string against the blackboard with one finger of the left hand, and stretches it tight, a circle of any desired diameter may be made. The finger marks the center. With a pin, a pencil, and a piece of cardboard with holes in it for the pin and pencil, circles may be drawn on paper. Circles may also be drawn with dividers or compasses.



The diameter of a circle is twice its radius. A radius is any straight line from the center to the circumference. The string makes the length of the radius of the circle drawn on the blackboard.

The circumference of any circle equals almost exactly three and a seventh times the diameter. We can prove this by drawing circles and comparing their diameters and circumferences.

1. Find the circumference of a circle 2 in. in diameter.

$2 \text{ in.} \times 3\frac{1}{7} = 6\frac{2}{7} \text{ in.}$

2. Find the circumference of a circle 4 yd. in diameter.

$4 \text{ yd.} \times 3\frac{1}{7} = 12\frac{4}{7} \text{ yd.}$

3. Draw circles of various diameters and find their circumferences.

In these questions we always need to know how to multiply a whole number and a fraction.

SCHOOL PER CENTS

1. John had 87% in his arithmetic, 60% in reading, 80% in manual work, 75% in drawing, 70% in music, 60% in spelling, and 90% in Nature study. What was his average, if each study counted the same?

87%
60
80
75
70
60
90
522

7)522
74⅔%

2. But what was his per cent if arithmetic counted 3 points, reading and manual work 2 points each, and the other exercises 1 point each?

87% × 3 = 261
60 × 2 = 120
80 × 2 = 160
75 × 1 = 75
70 × 1 = 70
60 × 1 = 60
90 × 1 = 90
11 836

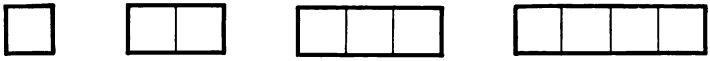
11)836
76%

3. Find the averages of various reports.

4. In a class of 36 boys and girls 33⅓% were girls. How many girls were there? How many boys? 50% were not absent in October. How many came every day? 25% were tardy once each during the entire school year. How many were tardy?

5. In another class of 45 boys and girls 33⅓% were girls. How many boys were there? How many girls? 80% were not absent in October. How many came every day? 9 were tardy once during the year. What per cent of 45 was that? What is the ratio of 9 to 45? $\frac{1}{5}$ is what per cent of 100?

RATIOS AND FRACTIONS



1. What is the ratio of A to B? of B to A? of A to C? of B to C?

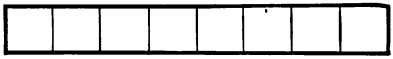
2. Why is the ratio of B to C $\frac{2}{3}$ and of C to B $\frac{3}{2}$?

3. What is the ratio of A to D? of D to A? of B to D? of D to B?

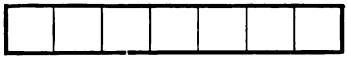
4. Why is the ratio of C to D $\frac{3}{4}$ and of D to C $\frac{4}{3}$?

5. What is the ratio of B to E? of E to B? of B to F? of F to B?

6. What fraction of E is C? D? of F is C? is D?



7. What is the ratio of G to H? of H to G? of D to H? of H to D?

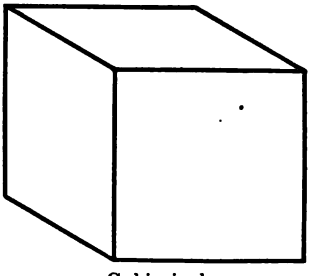


8. What fraction of H is B? is E? is F?

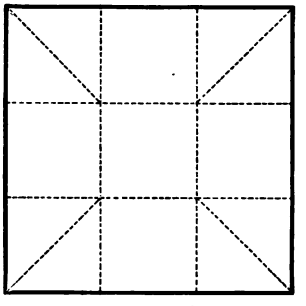
9. What forms show the ratio $\frac{7}{10}$? $\frac{5}{9}$? $\frac{3}{8}$? 4? $\frac{10}{6}$? $\frac{1}{2}$? $\frac{1}{3}$?

10. Fold paper to show fractions and ratios like these.

11. Make drawings of larger sizes, showing similar ratios and fractions.



Cubic inch



$1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.

MEASURES OF CAPACITY

A cubic inch may be represented in cardboard or heavy paper. Fold at the lines dotted. This will hold water, but dry sand may be used. The cardboard should be 3 in. × 3 in. in size.

4 gills make 1 pint.

1. Take a liquid gill measure and find how many cubic inches it contains.

2. Make a box of paper 3 in. × 3 in. × 3 in.

3. Find the number of cubic inches in a dry quart.

4. Find the contents in cubic inches of a drinking glass. Compare this with a pint.

5. Find the number of cubic inches in a liquid quart. Is this more or less than the number in a dry quart? By how much?

6. How many cubic inches are there in a box measuring 7 in. × 9 in. × 12 in.?

7. A cardboard box 3 in. × 7 in. × 11 in. will be found to contain almost exactly 1 gallon. What is its volume in cubic inches?

TABLES OF MEASURES

AREA	VOLUME
144 sq. in. = 1 sq. ft.	1728 cu. in. = 1 cu. ft.
9 sq. ft. = 1 sq. yd.	27 cu. ft. = 1 cu. yd.
43560 sq. ft. = 1 acre	CAPACITY
640 acres = 1 sq. mile	$31\frac{1}{2}$ gal. = 1 bbl.

1. The lot on which Mary's house stands is 60 ft. by 150 ft. What is its area?

2. The lot on which the school stands is 90 ft. by 484 ft. How many acres is the area?

3. There are 1170 sq. ft. in the carpet at the music hall. How many square yards are there in it? If it cost $260, what was the price per yard?

4. I bought a barrel of vinegar for $3, and sold 27 gal. at 10¢ a gallon. How many gallons were left; and how much money had they cost me?

5. There were 3000 cu. in. in the volume of an iron box. If it was 10 in. on one side and 30 on another, how many inches was it on the third side? Was its volume greater or less than 2 cu. ft.? By how much?

6. I found that what I supposed were 10 cu. yd. of earth in a space only 90 ft. by 6 ft. by 4 ft. What amount too small was the actual amount of earth there?

7. A lot of land, in the form of a right angled triangle, was 105 ft. on one side of the right angle and 255 ft. on the other side. What was the area of the triangle?

8. In 8 acres are how many sq. ft.?

9. In 12 bbl. are how many gal.?

ADDITION SUMS AND PROBLEMS

1.	2.	3.	4.	5.
93	6702	417	4	300
618	564	64	85	761
4192	83	8163	307	95
1216	1709	350	6890	8
904	341	19	42	604

6.	7.	8.	9.	10.
6819	17	7621	38	3042
1706	420	874	2719	817
324	1608	19	450	96
8270	9743	3240	8063	2403

11.	12.	13.	14.	15.
7268	2763	8006	6543	6207
3917	9208	3952	9876	8392
8068	593	7688	5678	6749
765	8637	2765	2345	9370

16. The railroad route from Albany to New York is 144 miles in length; from New York to Philadelphia it is 96 miles; from Philadelphia to Washington it is 136 miles. How many miles long is the distance from Albany to Washington?

17. A man spent $174 a year on clothing for his family, $369 for food, $168 for interest, $69 for fuel, $27 for light, $77 for furniture, $84 for labor, and $67 for life insurance; he also paid $18 to a doctor and $24 in taxes. How much a year did he spend in all?

18. A merchant's sales amounted to $395 on Monday; $278 on Tuesday; $647 on Wednesday; $594 on Thursday; $295 on Friday, and $947 on Saturday. What was the total value of his week's sales?

REVIEW QUESTIONS

1. One train travels 50 miles an hour and another train 30 miles an hour. They start together at the same time in the same direction. How far apart will they be at the end of an hour?

2. What number is that from which if I take away the sum of 5, 3, and 8, there will be 4 left?

3. After having had 1260 men killed and wounded and 7200 taken prisoners by the Boers, the British South African army numbered 196,800. Before these losses how many men were in the British army in South Africa?

4. The difference between two numbers is 118, and the greater number is 1801. Find the smaller number.

5. There are 140 pages in a Reader and 120 in an Arithmetic. How many more pages are there in the Reader than in the Arithmetic?

6. The Old Testament contains 23,145 verses, and the New Testament 7957 verses. How many verses are there in the whole Bible? How many more verses are there in the Old Testament than in the New?

7. Annie bought a Third Reader for 36¢, a Geography for 60¢, and a Speller for 17¢. She gave a two-dollar bill to the clerk. What change should she get?

8. A man borrowed $2790 and promised to pay $285 for the loan. He repaid $764 at one time, $847 at another, and $793 at another. What did he then owe?

9. Willie attended school 15 days in January, 17 in February, 16 in March, 16 in April, 21 in May, and 18 in June. If there were 120 school days in the six months, how many less days did he go to school than Johnnie, who was not absent even one day?

REVIEW QUESTIONS

1. A farmer had 120 acres of land, and bought 87 acres more. He afterwards sold 68 acres. How many acres had he then?

2. In the first car of a railway train there were, on starting, 29 passengers; in the second, 27; and in the third, 15. At the first stopping place 19 passengers got out and 7 others got on board. How many passengers were there on the train then?

3. A man had to put 73 head of cattle into four cars. He put 18 into the first car and 19 into the second car and 19 into the third car. How many head were left to go into the fourth car?

4. A man bought a horse for $97 and another one for $85. He sold the two horses for $163. How much did he lose on them?

5. I sold goods for $1225, gaining thereby $248. How much did the goods cost me?

6. One week a wheat buyer gained $2741, the next week he lost $713, the next week he lost $1284, but the next week he gained $925. How much more did he gain than lose during the month?

7. A man's salary is $1420 a year, and he has a property that brings him in $225 a year. If his expenses are $975 a year, how much money can he save in one year?

8. A man bought 100 acres of land for $5750. He paid $1235 in cash, and gave a mortgage for the rest of the purchase price. What was the sum for which the mortgage was given?

9. Mr. Jones owed Mr. Smith $163; in payment he gave a horse and $49 in cash. At what was the horse valued?

GENERAL MULTIPLICATION TABLE

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

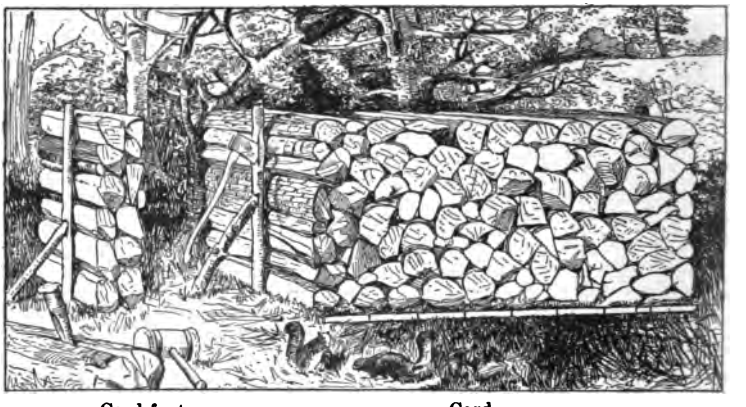
1. Read the multiplication table of each number, beginning $2 \times 1 = 2$, $2 \times 2 = 4$, $2 \times 3 = 6$, and so through 2's; then $3 \times 1 = 3$, and so on through all numbers.

2. Read the division facts in this way, beginning $4 \div 2 = 2$, $6 \div 2 = 3$, $8 \div 2 = 4$, and so through the first column; then $6 \div 3 = 2$, $9 \div 3 = 3$, $12 \div 3 = 4$; and so on through all the numbers.

3. Read the columns down, 2, 4, 6, 8, and so on; 3, 6, 9, 12, and so on, telling in what multiplication table we find these numbers.

4. What numbers multiplied together give 144, 132, 121, 120, 110, 108, 100, 99, and so on through all these numbers?

CORD WOOD



Cord foot Cord

A cord of wood is as much wood as is contained in a pile measuring 4 ft. × 4 ft. × 8 ft.

A cord = 128 cu. ft. in space.

The wood is piled as it comes, and the space not actually taken by wood counts just as much as the solid wood.

A cord foot is 4 ft. × 4 ft. × 1 ft.

A cord foot = 16 cu. ft. of space.

1. How many cord feet are there in a cord?

2. Will's father bought 20 cords of wood. If this was piled 4 ft. wide and 8 ft. high, how long would the pile be?

3. What part of a cord is 2 cord feet? 3 cord feet?

4. A pile of wood 4 ft. × 12 ft. × 12 ft. was offered to John Douglas at $5 a cord. He found the amount of the bill in this way:

$4 \times 12 \times 12 = 4 \times 3 \times 4 \times 3 \times 4 = 4 \times 4 \times 4 \times 3 \times 3 =$
$\frac{1}{2}$ cord $\times 9 = \frac{9}{2}$ cords $= 4\frac{1}{2}$ cd. $\$5 \times 4\frac{1}{2} = \$20\frac{1}{2} = \$20.50.$

Can you follow these steps?

BILLS

When we buy things at stores we often get bills.
This is a bill of goods, sold to Mr. Thomas Davenport:

3	yd. calico	@ 6¢	.18
5	yd. flannel	@ 30¢	1.50
1	pr. shoes	@ 2.75	2.75
8	handkerchiefs	@ 15¢	1.20
			$5.63

Is this bill correct?
Draw up other bills.

RATIOS OF MEASURES RECITE

1. What is the ratio of $1 to 10¢? of 25¢ to $2?

2. What is the ratio of 1 ft. to 2 yd.? of 3 yd. to 2 ft.? of 2 ft. to 4 yd.?

3. What is the ratio of 1 gill to 1 gal.? of 2 gal. to 3 pt.? of 3 pt. to 1 gal.?

4. What fraction of 1 hr. is 2 min.? 5 min.?

5. How many times larger is a bushel than a quart?

6. What is the ratio of a ton to five hundred pounds?

7. The ratio of the distance I ran to the number of feet in a mile was $\frac{1}{4}$. How far did I run? Answer in feet and in miles.

8. What is the ratio of 10 quires to a ream? Of a ream to 5 quires? Of a ream to 60 quires?

DECIMALS

We found that we could write five dollars and twenty-eight cents $5.28. We called the period or point between 5 and 2 the **decimal point.** Decimal means ten or tenth. In our notation we used these orders.

Hundreds	Tens	Units
6	3	9

We can extend decimals to the fractions, tenth and hundredth, by the use of the decimal point.

Hundreds	Tens	Units	Decimal Point	Tenths	Hundredths
6	3	9		4	2

39.4 is read thirty-nine four tenths. $39.4 = 39\frac{4}{10}$.

39.42 is read thirty-nine forty-two hundredths.

The whole number may be written $639\frac{42}{100}$.

1. Write in decimals $756\frac{84}{100}$; $\$15\frac{65}{100}$; $56\frac{1}{10}$ yd.

2. Read 15.3%; 2.7 hr.; 9.3 mo.

3. I bought 7.4 oz. of a very expensive kind of tea especially imported from China. I paid 10¢ an ounce. What was the cost?

Multiplying decimals by tens or hundreds is very easy.

$7.4¢ \times 10 = [7 \times 10]$ and $[\frac{4}{10}¢ \times 10] = 70¢ + 4¢ = 74¢$.

We can multiply a decimal by ten simply by moving the decimal point one place to the right, as you see.

4. If I had paid 20¢, what would have been the cost?

$20¢ = 10¢ \times 2$. $7.4¢ \times 10 = 74¢$. $74¢ \times 2 = 148¢$. $148¢ = \$1.48$.

Do you see that we can change cents to dollars by moving the decimal point 2 places to the left?

$100¢ = \$1$. $148¢ \div 100 = \$1.48$.

TABLES

Dry Measure

2 pints	= 1 quart	2 pt.	= 1 qt.
8 quarts	= 1 peck	8 qt.	= 1 pk.
4 pecks	= 1 bushel	4 pk.	= 1 bu.

Liquid Measure

4 gills	= 1 pint	4 gi.	= 1 pt.
2 pints	= 1 quart	2 pt.	= 1 qt.
4 quarts	= 1 gallon	4 qt.	= 1 gal.

Time Measure

60 seconds	= 1 minute	60 sec.	= 1 min.
60 minutes	= 1 hour	60 min.	= 1 hr.
24 hours	= 1 day	24 hr.	= 1 da.
7 days	= 1 week	7 da.	= 1 wk.
12 months	= 1 year	12 mo.	= 1 yr.
30 days count usually as 1 month		30 da.	= 1 mo.
365 days count usually as 1 year		365 da.	= 1 yr.

Length Measure

12 inches	= 1 foot	12 in.	= 1 ft.
3 feet	= 1 yard	3 ft.	= 1 yd.
5280 feet	= 1 mile	5280 ft.	= 1 mile
1760 yards	= 1 mile	1760 yd.	= 1 mile

Weight Measure

16 ounces	= 1 pound	16 oz.	= 1 lb.
2000 pounds	= 1 ton	2000 lb.	= 1 T.

U. S. Money

5 cents	= 1 nickel	5¢	= 1 n.
10 cents	= 1 dime	10¢	= 1 d.
100 cents	= 1 dollar	100¢	= $1

TESTS

1. Beginning at 1, count by 11 to 144.

2. What is a thermometer? What does it measure? How?

3. What is the *multiplicand*, the *multiplier*, and the *product* in multiplication?

4. Which is the larger, one eighth or one twelfth of anything? one tenth or one fiftieth? Why? What is the ratio of $\frac{1}{8}$ to $\frac{1}{16}$? of $\frac{1}{10}$ to $\frac{1}{50}$?

5. What are the *dividend*, the *divisor*, and the *quotient* in division?

6. Tell the Roman notation for the present year.

WRITE

7. Add \$13.25, \$26.14, \$168.90, and \$1000.

8. Write the heading of a letter with date and addresses of your correspondent and yourself.

9. I bought 4 pair of shoes @ \$2.60 each. What was their cost?

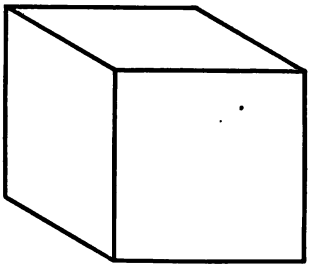
10. The principal of a school received 2864 cents from a school entertainment as a picture fund, and divided the money equally among eight class rooms. How many dollars did each room receive?

11. Show by drawings these fractions: $\frac{4}{9}$, $\frac{3}{8}$, $\frac{5}{7}$, $\frac{3}{10}$, $\frac{2}{15}$.

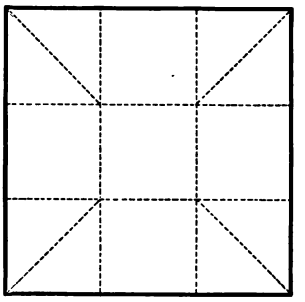
12. Mary gave $\frac{1}{3}$ of $\frac{1}{6}$ of 36 apples to each girl in her class, and had none left. How many girls were there in the class?

13. Subtract $2130\frac{1}{2}$ acres from $4360\frac{3}{4}$ acres.

14. What per cent of \$2.00 is 66¢?



Cubic inch



$1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.

MEASURES OF CAPACITY

A cubic inch may be represented in cardboard or heavy paper. Fold at the lines dotted. This will hold water, but dry sand may be used. The cardboard should be 3 in. × 3 in. in size.

4 gills make 1 pint.

1. Take a liquid gill measure and find how many cubic inches it contains.

2. Make a box of paper 3 in. × 3 in. × 3 in.

3. Find the number of cubic inches in a dry quart.

4. Find the contents in cubic inches of a drinking glass. Compare this with a pint.

5. Find the number of cubic inches in a liquid quart. Is this more or less than the number in a dry quart? By how much?

6. How many cubic inches are there in a box measuring 7 in. × 9 in. × 12 in.?

7. A cardboard box 3 in. × 7 in. × 11 in. will be found to contain almost exactly 1 gallon. What is its volume in cubic inches?

ADDITION SUMS AND PROBLEMS

1.	2.	3.	4.	5.
93	6702	417	4	300
618	564	64	85	761
4192	83	8163	307	95
1216	1709	350	6890	8
904	341	19	42	604

6.	7.	8.	9.	10.
6819	17	7621	38	3042
1706	420	874	2719	817
324	1608	19	450	96
8270	9743	3240	8063	2403

11.	12.	13.	14.	15.
7268	2763	8006	6543	6207
3917	9208	3952	9876	8392
8068	593	7688	5678	6749
765	8637	2765	2345	9370

16. The railroad route from Albany to New York is 144 miles in length; from New York to Philadelphia it is 96 miles; from Philadelphia to Washington it is 136 miles. How many miles long is the distance from Albany to Washington?

17. A man spent $174 a year on clothing for his family, $369 for food, $168 for interest, $69 for fuel, $27 for light, $77 for furniture, $84 for labor, and $67 for life insurance; he also paid $18 to a doctor and $24 in taxes. How much a year did he spend in all?

18. A merchant's sales amounted to $395 on Monday; $278 on Tuesday; $647 on Wednesday; $594 on Thursday; $295 on Friday, and $947 on Saturday. What was the total value of his week's sales?